Vol. XXI. September, 1906. No. 3.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION. PAVING. SEWERAGE.
WATERWORKS. STREET LIGHTING.
PARKS. GARBAGE DISPOSAL. BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS AND NEW YORK.

Registered in United States Patent Office

Two Dollars Per Year. Single Copies, 25 Cents.

THE HAND-BOOK
FOR
CEMENT USERS

¶ The third edition of which has just been printed, is the most practical work on the use of cement yet published. ¶ Contains no burdensome theory, but gives facts, demonstrations and examples of work that has been actually performed and proved practical and satisfactory. ¶ Informs you how to select the best cement, write specifications for cement, write specifications for the work into which the cement is to go, put the work together, estimate the cost of materials, and estimate the quantity of material. ¶ Remember it is a practical work for practical men.

HERE ARE A FEW EXPRESSIONS FROM SOME OF THE READERS OF THE NEW EDITION

J. FINGER, FT. COLLINS, COLO.—"I received your Hand-book, and like it very much."

CEMENT PRODUCTS CO., ESTHERVILLE, IOWA.—"Enclosed find $3.00 for Cement Users' Hand-book. Glad it's out. No fears of getting less than our money's worth."

MARTIN T. ROCHE, ALPENA PORTLAND CEMENT CO., ALPENA, MICH.—"I enclose my check for $6.00 in payment of the Hand-book for Cement Users sent me last week; and also to cover price of another copy of the same book. They are good stuff."

375 pages, cloth bound, price, $3.00

MUNICIPAL ENGINEERING CO., 28 S. Meridian St., Indianapolis

THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY
MANUFACTURERS AND CONTRACTORS FOR OVER 50 YEARS OF
Fire Alarm and Police Signal Telegraphs
AND FOR SPECIAL APPARATUS THEREFOR.

OVER 1,200 Plants in actual service in the United States and Canada. Plants also established in Cuba, Philippine Islands, South America, Germany, Hawaii, West Indies, England, Norway and South Africa.

JOSEPH W. STOVER, President C. W. CORNELL, Secretary H. F. BENDER, Treasurer
WILLIAM GELLATLY, Gen. Supt.

EXECUTIVE OFFICE 19 BARCLAY STREET, NEW YORK CITY

COAL TAR PAVING AND ROOFING MATERIALS

ACCURATELY REFINED AND SCIENTIFICALLY PREPARED

SOLD WITHOUT RESTRICTION

E. B. WARREN COMPANY,

IN BUSINESS 45 YEARS

27TH AND H STREETS, N. W. WASHINGTON, D. C

MUNICIPAL ENGINEERING

VOLUME XXXI. SEPTEMBER, NINETEEN HUNDRED SIX. NUMBER THREE

REINFORCED CONCRETE PIPE.

Concrete has been used for making sewer pipe and for making sewers laid continuously for many years, but the use of steel for reinforcing the concrete is very recent. Descriptions of several reinforced concrete sewers, laid in place, have been given in MUNICIPAL ENGINEERING within the last two or three years. The successful use of reinforcement in making concrete sewer pipe warrants a description of the process.

I. 42-INCH REINFORCED CONCRETE PIPE SEWER, ST. JOSEPH, MO.

The pipes are made along the line of the work in molds made for the purpose. The inner wall of the form is first set in place. It is composed of rolled sheet steel sections set in the upper and inner flange of a bottom plate or ring. The longitudinal reinforcing bars are then set in position, being inserted in pockets in the bottom ring. These bars are turned over at the ends to form hooks turning outward. The outer wall of the form is then put in place, being similar in construction to the inner wall. It rests on the lower and outer flange of the bottom plate. Space clips at the top hold the reinforcing bars in position.

The completed mold is filled about one-fourth full of concrete, which is thoroughly tamped. The space clips at the top are then removed and a circular reinforcing bar is inserted encircling the inner mold wall and gauged in position within the concrete by means of slot punches, which receive and accommodate the reinforcing bars. The space clips are then adjusted, the mold is filled three-quarters full, another circular reinforcing bar is

inserted and the remainder of the pipe is completed.

The hooks on the ends of the longitudinal reinforcing bars project into the annular space about the flange produced by the form of the bottom plate or ring, and when the pipes are laid in the trench these hooks can be interlocked, thus making the sewer practically continuous in reinforcement. One end of the pipe has a projecting flange and the other a re-entrant flange, so that consecutive pipes mesh together. When the annular spaces at the joints are filled with mortar the sewer becomes a continuous pipe.

Each section of pipe is made on the surface of the ground and is open to inspection throughout the process. Each section of pipe can also be tested if desired, before it is put in place in the sewer. There is, therefore, no doubt as to the proper construction and the strength of every section of the sewer.

Sewers are made according to this process of diameters from 15 inches to 6 feet.

Several sewers were recently constructed according to this system at St. Joseph, Mo., some description of which was given in a recent number of MUNICIPAL ENGINEERING. A harbor line has been established along the river front which is from 175 to 375 feet outside the former main bank of the river. The Union Terminal Railroad is reclaiming this area, about 35 acres, by filling it, and it was necessary to extend several of the city's main sewers which discharged into the river along the 5,300 feet of water front affected by the improvement. Much of the filling below high water was made by building a dike, which retarded the current over the area to be filled and caused the deposition of the silt from the river. The filling above the deposits thus made up to a level eight feet above high water, was made by pumping the sand and silt from the bottom of the river.

Before the filling could be done, cross dikes were built on the lines of extension of the sewer and the extensions of the sewers were laid with reinforced concrete pipe supported on transverse timbers carried on the lower longitudinal stringers on the piles of the dikes. The first of the accompany cuts shows a 42-inch sewer in place on the timber foundation described, ready for the filling over it. The transverse timbers shown are 18 inches apart, so that each 3-foot section of pipe is supported at two points. The second cut shows a 72-inch sewer laid in place. The third cut shows a section of 72-inch pipe lifted and ready to place in the trench. The fourth cut shows the collection of forms on the ground ready to make the pipe. The pipes used in the work at St. Joseph, Mo., were 36, 42, 48 and 72 inches in diameter, and they were built in 3-foot sections.

We are indebted to the Reinforced Concrete Pipe Company, of Jackson, Mich., who constructed the work described, for the information contained in this article and for the accompanying photographs.

CHEAP ELECTRIC POWER IN CHICAGO.

By Alton D. Adams, Worcester, Mass.

Chicago and the sanitary district are to have electric energy at the rate of 0.41 cent per kilowatt hour from the water power plant on the drainage canal at Lockport. This rate is based on the price of $26.40 per electric horse power year made by the trustees of the district for continuous service from its sub-station located at West Forty-eighth avenue, Chicago, and the canal. If energy it only wanted during twelve consecutive hours per day, the price made by the trustees is $20 per electric horse power year. On the basis of continuous use during twelve hours per day and 365 days per year, this price of $20 corresponds to a rate of 0.608 cent per kilowatt hour, and if the use is during twelve hours per day and only 300 days per year, the corresponding rate is 0.734 cent per kilowatt hour. Even if the total yearly use per horse power of maximum demand averages only ten hours per day for 300 days per year, corresponding to a load factor that is exceeded in many electric supply systems, then at the price of $26.40 per electric horse power hour per year for continuous service, the corresponding rate is 1.17 cents per kilowatt hour.

These prices for electric power are made to Chicago and to the other municipal corporations that go to make up the 167 square miles of Cook County, outside of that city, that are included in the sanitary district of Chicago. Energy from the switchboard in the substation is to be delivered at either 6,600, 9,000 or 11,000 volts, as desired, in the form of three-phase, sixty-cycle current, and the transformation and conversion of this current for general distribution, must be carried out by the municipal authorities

II. LOOKING INSHORE FROM OUTFALL OF MESSINA STREET SEWER (48 INCHES), ST. JOSEPH, MO.

that purchase it. In six or seven years from this date, it is expected that a larger flow of water will be available in the canal, and it is the intention of the trustees to reduce the price to $14.97 per electric horse power year, when the capacity of the plant reaches 31,000 horse power.

Between the rate of 1.17 cents per kilowatt hour, computed above on the basis of the charge of $26.40 per electric horse power per year, and a full load on an average during only 3,000 hours yearly, and the rates commonly collected by the electric light company in Chicago, there is a wide margin, and it will be interesting to note the policy as to rates adopted by that city. Take for illustration the consumer in Chicago who is paying the ordinary rate of 10 cents per kilowatt hour for energy used in electric lighting, this rate is more than eight times the 1.17 cent rate to the city of Chicago. How much will that city charge the private consumer?

It should be noted that the three-phase, sixty-cycle current delivered at the substation of the sanitary district is suitable for general light and power supply as soon as it is transformed to lower voltages. Lighting customers are in many cases charged twice as much per kilowatt hour as are those who use electric energy for motive power, and this should be borne in mind when comparing the above rates of the sanitary district with rates made by electric supply companies for motor service. Some difference between lighting and power rates rests on the cost of lamps, and the more accurate regulation of voltage which they require over that for motors.

BUILDING MATERIALS IN THE SAN FRANCISCO EARTHQUAKE.

Mr. Wm. Ham. Hall, M. Am. Soc. C. E., a civil engineer of national reputation, and a resident of San Francisco since 1853, made a careful examination of several hundred buildings after the San Francisco earthquake and fire, and wrote a series of articles for the *San Francisco Chronicle*, which give much valuable information regarding the reasons for the great differences in the effects of the earthquake upon buildings and streets.

These differences had two main causes, besides many of minor importance. A part of the city is built upon ground which has been reclaimed from the bay, or from low and marshy conditions, by filling, this part including much of the business part of the city, while most of the city is built upon the hills, the foundation of which is solid rock. The second cause is found in the differences in methods of building. A very large proportion of the San Francisco building has been done hastily and cheaply, low cost being the first consideration, appearance the second and solidity a third, often left out of sight.

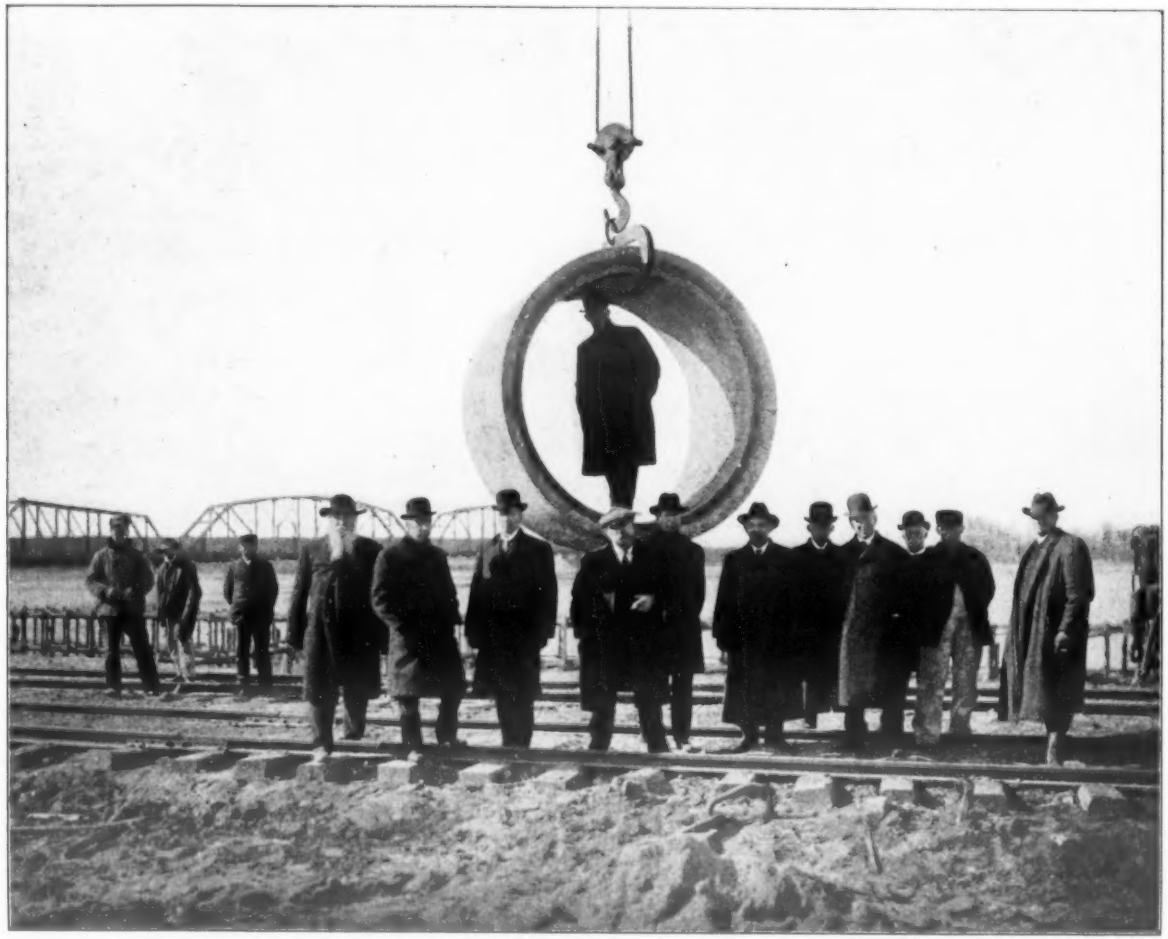
Mr. Hall takes the U. S. Coast Survey charts made in 1857, and his own memory as guides to the original location of the shore line of the bay, and goes over the serious disturbances in the ground surface in considerable detail, showing that their limits are very closely those of the fills which have been made. Every subsidence or notable movement of the earth is along the edge or within the area which was "formerly swamp, salt marsh, mud flat or bay estuary." Below the bounding line of the filled area "the streets are nearly all waved, there being depressions of from six inches to as much as four feet in one or two places and two or three feet at quite a number of points. While it cannot be said that the whole street area within the zone has sunk, a considerable portion of it has, and near the water front most of it has sunk from six to twelve inches, with several areas of greater depression."

Mr. Hall gives the details of many of these settlements, among them the following:

A curious revelation is noticed on the west side of Davis street, between Broadway and Pacific street. Here in 1857 was the water-front wharf. When the street was filled in it is evident that all the piles were not removed. The street pavement, which is basalt blocks, has sunk six inches or more for the full length of the frontage, and the position of the pile heads for about half the length is marked by their punching the pavement up in little pyramids, and for the other half length the position of the pile bents with caps on is shown by the pavement sinking on either side of the caps, leaving ridges of paving blocks over them. Evidences of old structures beneath the surface and filling are brought out in a similar way at a number of points.

The foregoing tells in general terms about the whole story of the effect of the earthquake on the soft spot in the main part of the city.

It indicates, and the details on which it rests clearly prove this and nothing



III. PIPE MANUFACTURED FOR UNION TERMINAL RAILROAD COMPANY, ST. JOSEPH, MO.

more—that the mud and heterogenous fillings over which we have been making and paving streets for half a century have not in that time been settled, but that Temblor Rex, 1906, has consolidated them for us.

The writer has no disposition to minimize conclusions from these phenomena. Locally and as affecting property within the areas, they may, in a way, be grave. But San Francisco, situated in by far the greater part on firm high land and rock hills, as a site for a city is not to be judged of or discredited by the subsidence or slipping of its heretofore unsettled soft spots.

The construction of buildings and their foundations is then considered in considerable detail and the following extracts and abstracts are taken from the articles to show the nature of the points made::

In common parlance, "the earthquake was much less severe on the hills than in the valleys," or "much more severe in the lower than on the higher parts of the city." And, as a rule well supported by the visible effects, this is literally true. But the exact facts probably were, and a thorough account would doubtless furnish many examples to prove them:

First, that the shake in the solid substrata under the valleys in the lower parts of the city was no greater than it was in the same strata, which, folded to higher elevation, form our hills.

Second, that the greater apparent severity of the shake in the valleys and lower places was due to special disturbances of theretofore unsettled artificial fillings, or unconsolidated natural sand, earth or mud formations, which were easily susceptible of movement within themselves; and

Third, that the greater effects on structures located in the valleys than on similar structures placed upon the hills and higher parts was due to lack of proper artificial foundation support for buildings in the valleys, considering the unstable character of the foundations on which they rested.

Buildings on firm rock areas, and without any provision of deep artificial foundations, suffered less than similar buildings located on sand, loose earth or filled areas and provided with rigid artificial foundations, and far less than those so placed but without provision of such unyielding resting places.

Brick buildings, for instance, placed upon the original mud flat part of the city were, as a rule, provided with piled or deep unyielding foundations, while brick buildings built in back-lying valleys formerly marshy and soft, but later filled over with sand, were not so founded. A number of brick buildings in such valleys were very badly shaken up, and some were virtually destroyed. It is believed that all so located and deficient as to foundation were much worse injured than brick buildings built on good artificial foundations, but on worse natural formation near the bay front; while brick buildings on the rock and clay hills around the valleys, and which were not provided with deep foundations of any kind, as a rule, received comparatively little or no material earthquake damage.

The lesson of this is that we must know the natural formation in each case and make sure that we adopt and provide the suitable and sufficient artificial foundations to hold the structure on that formation, whatever it may be. To be earthquake-proof, the building must be on a resting place which, though bearing its load, will remain rigid under earthquake shock.

Wood, as an earthquake resisting material, within the limits of application for buildings of, say, four stories or less in height and not intended to carry heavy loads, has been proven safe and reliable. Much of the application of wood in San Francisco building practice has been abominable, and it is this faulty application and not the material itself which was responsible for earthquake disaster to wooden construction. Remember, this does not cover questions raised by the fire.

Where wooden buildings failed under earthquake shock, or show material injury therefrom, the cause clearly was, either (1) location upon loose earth or sand formation, or upon fillings over soft substrata, without provision of adequate artificial foundation; (2) defective artificial support; (3) old and rotten condition of the building itself; (4) slight construction, not up to a reasonably good standard; (5) from falling brick chimneys, or (6) from several of these causes combined.

The steel frames, as such, of the so-called "class A" buildings, without exception, as far as is known, withstood the effect of this violent and really vicious earthquake, practically uninjured. There was no toppling over, collapsing or even tipping out of plumb, of any one of the tall structures, such as had been freely predicted by the timorous. Damage to the encasing walls of stone veneer, brick or terra cotta of such steel-frame buildings, is, of course, aside from injury to the frames. This is to be guarded against in the casings themselves, in the bonding of them to the frames, and in

V. FORMS ON THE GROUND FOR MAKING REINFORCED CONCRETE PIPE, ST. JOSEPH, MO.

part, by making stiffer frames which will not so much rack the casings.

Whatever earthquake destruction came to structures embodying steel framing was due to incompleteness of such framing—sacrifice of the integrity of the steel frame by incorporating part of a frame with members (walls) of less integrity, in forming the support of a building as a whole. The failure or partial failure of such buildings is not, of course, to be counted against the class of buildings which have complete steel frames.

At the same time it was made apparent that steel framing in general must, to insure immunity from earthquake damage to the encasing walls and some other parts of the structure, be better braced.

If the earthquake of April 18, 1906, demonstrated anything, it was the easy possibility of erecting steel-frame buildings which will withstand other, and even worse, earthquakes, without suffering material damage in any part.

The encasing walls of steel-frame structures, whether the materials were of stone, terra cotta or facing bricks of some kind backed with common brick, have in a number of instances been displaced or cracked. Apparent cracking of such a wall along joints may have been due solely to lack of bond between backing and facing—the thin facing being left to maintain its own integrity. But there are cases of cracking of facing materials together with the backing, and this seems to indicate that the steel frame was too light and insufficiently braced, and that it swayed or bent beyond the limit to which its encasing walls could go without rupture.

As a rule, the heavier steel-frame buildings having encasing walls of stone in thick veneer, well and solidly backed, showed to outside appearance the least damage, while those whose encasing walls are wholly of brick showed the most damage. There are notable exceptions to this rule, as to brick facings.

The places were very few where stone slabs of incasing walls on steel frame buildings were cracked or splintered by the earthquake. But there were quite a number of places where they were displaced, forming cracks at the ashlar joints.

There were a number of places where bricks of incasing walls apparently were cracked, many where facings were badly cracked on the lines of mortar joints, and many where the facings separated from the backings, and several where they had fallen to the ground.

Hard-burned terra cotta bricks and other hard-burned bricks stood in incasing walls of steel frame structures better than soft bricks, and in several cases stood equally well with stone slab facings.

Terra cotta facing construction, other than in hard-burned brick form, with several notable exceptions, suffered more from the earthquake than did stone slab facings.

Plain terra cotta facing slabs in places were crushed, and much ornamental work in terra cotta facings, as in the bases and capitals of pilasters, in cornices, etc., were cracked or crushed.

The writer bases these foregoing statements mainly upon what he saw, personally, after the earthquake and before the fire and dynamiting.

Tile, or so-called terra cotta partitions, suffered from the earthquake shock, causing cracking of plaster and weakening and (rarely) displacement of the partition itself. Apparently this was not only because of frail formation of the partition blocks, but because of the flimsy manner in which such material is laid up, and the weak mortar used in such laying.

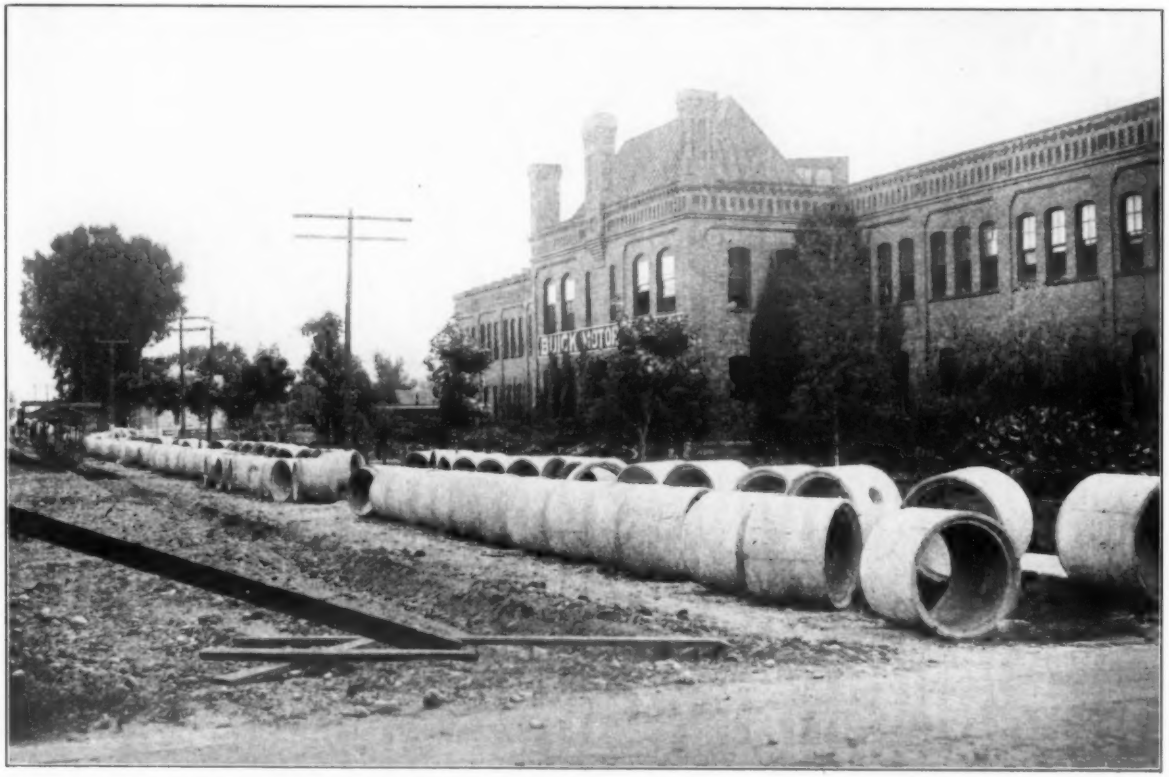
Concrete compositions in all their applications in steel frame structures suffered least from earthquake effect. This means concrete, not mere sand and cement or plaster compositions, nor much rotten stuff put in under the name of concrete.

Cement bricks used in facings were displaced, as were other bricks, but this was probably due to the brick form and size, and consequent lack of bond, and not to the composition of the bricks.

Ordinary brick walls, except in cases where well tied in by cross-walls of the same material or by rods properly applied to serve as binding members of the structure, which cases were rare exceptions, very generally and to some extent, at least, failed in some one or more of the sides of an immense number of buildings. By "failed," in this connection, is meant at least cracked to such an extent that it would seem that the wall would have to be taken down and rebuilt in order that the structure might be entirely safe.

Buildings having interior cross walls of brick suffered far less than those having only exterior walls of brick. Angles as well as cross walls in brickwork seem to have been elements of strength.

Brick chimneys by the thousand, and on buildings of almost all classes, were snapped off, in some cases almost as though they were cut, on the plane of the roof, whatever its slope was. In lesser but still in great number chimneys were also cracked across at floor



V. 36-INCH REINFORCED CONCRETE PIPE, WISNER ST., JACKSON, MICH.

levels below the roof line, as became apparent in many chimneys left standing within the burned area where wooden houses had been consumed.

Many brick chimneys built up outside of wooden residences and not anchored thereto were thrown out bodily and broken off at some plane near the foundation line, and others were split asunder down the lines of the flues, the outer half crumbling to the ground while the inner half clung to the building by the fireplaces built around some wooden timber.

Such facts as these, taken with the destruction of so great a part of this city by fire originating from broken chimneys, go to show the danger of poor chimney construction and the prevalence of such work here.

The undeniable facts brought out by the earthquake are: (1) That much of the brickwork of San Francisco and bay region cities was extremely bad; (2) that most of it was decidedly not good; (3) that brickwork which was not good masonry quite generally failed; (4) that even good brick masonry, in many cases, and depending upon the formation on which located and the foundation provided, was ruptured; (5) that some which was good but on formations not firm seriously failed, while (6) really good brickwork located where the formation is solid and on foundations understood to be good was injured but little or not at all.

It is remarkable that one of the most notable and complete failures of a brick structure in San Francisco was the case of a large church in which the brickwork was splendid. The cause was failure of the roof beams, through dry rot, at the points of joining the walls, immediate dropping of the roof within the walls, and consequent battering out of the walls by movement of the roof timbers under earthquake influence. There was nothing sham about this building, but it was unfortunate that so fine and large a pile of good brick masonry should be crowned with a wooden frame roof and with towers of a kind which probably contributed to the demolition of the roof and consequent ruin of the building.

One of the most instructive lessons is to see, in parts of the best residence quarter of the city, where the formation is firm rock, a handsome brick shell over a wooden frame and sheathing, its veneering literally shaken to pieces; a notably pretentious structure of stone veneer over brick backing, in good part demolished, and a handsome solid-wall large brick house, showing no injury whatever. A number of such contrasting examples can be found along side of or in close proximity of each other, in several neighborhoods. The earthquake has put a definition on the word "sham" which seems positively cruel, and it has established a value on the solid foundation and genuine superstructure which is indeed ennobling.

As a rule, ashlar wall work was not at all injured by the earthquake, and, so far as noticed, no serious failure of an ashlar wall occurred which could be laid to any deficiency of strength in the wall itself to withstand the earthquake shock.

Stone block plate pieces of brick columns and other stone inserts in brickwork in all cases seem to have strengthened the structures. The walls of several notable brick buildings into which granite plates, slabs or tables were built to full-wall thickness have passed through the ordeal of earthquake, fire and blasting to much better advantage than other good walls of brick only, though the granite of the inserts is, of course, badly scaled by the flames.

It can not be said that to failure in stonework was due any part of the burning of San Francisco, as is attributed to failure of the brickwork of chimneys. Most of our ashlar work stayed where it had been put; but in places our sidewalks were mashed under veneer slabs and cornices of ashlar stone. These places were limited in number and extent, to be sure; but more than enough happened to prove that the architect's work could have been better done, even in several of our first rate buildings, by providing more effectual anchorage for the facing and trimming parts of his structure.

There are many buildings of (reinforced concrete) construction, most of them recently erected, in eastern states, and very many in Europe. Fortunately a few complete structures, though by no means of the best or most finished types, as well as very many examples of reinforced concrete construction of parts of buildings, are to be found within the radius of our recent trying shake.

These buildings and parts of buildings passed the ordeal of earthquake practically uninjured. Where failure of reinforced concrete can be found, it plainly was consequent upon primary failure of other materials or upon inexcusable rottenness of the concrete itself. For concrete can be, and often is, made as abominably bad as any other class of construction.

Reinforced concrete walls of buildings withstood the earthquake where brick walls and combined brick and stone walls, both good, according to California

standards, have failed in material degree, or were, in part, demolished.

Reinforced concrete foundation and basement walls, of which there are many, were, so far as can be learned, wholly uninjured, or in a few cases show only knife-edge cracks, immaterial to their integrity. The same may be said of retaining walls. But there are cases of concrete walls, not reinforced and not provided with expansion joints, which do show cracks of larger dimensions, though no well-built concrete wall, even though not reinforced, has been found which was materially injured by the earthquake.

Reinforced concrete roofs and floors passed triumphantly through the earthquake, and such floors held a number of brick buildings in good shape under earthquake stress, which, judging by effect on buildings of the same class that did not have such floors, would have materially suffered from the shock.

Reinforced concrete floors have not always been of the best construction in San Francisco, but it is wonderful how they bore the strains which must have been put upon them. A few are now seen to have failed under the blasting and demolition influence of the fire, and this appearance must not be counted as of earthquake influence.

As to the effect of the fire upon building materials, Mr. Hall states the following conclusions:

Granite has for the thousandth time and over been proved to be utterly worthless under flame influence. What a pity it is to spend millions in a construction which, without itself being combustible, is but little more fireproof than wood! You only have to allow a hot flame to play upon a granite column or wall to have the structure scale away to nothing.

Sandstone has again, and for a time beyond remembering, shown that in this respect it is little if any better than granite. Who can look at the scarred faces of some of our immense and handsome structures without a sigh, a tear or a swear?

Basalt has flown to pieces under heat almost as ice under a pick. In many places our street pavements splintered under fire influence. It would be profitless til they made pretty fair macadamized roads for light vehicle travel.

Ordinary first-rate building bricks have in places been cooked so that a single brick may be crushed under the heel, and scales half an inch thick may be kicked off from standing walls.

Some patent and special bricks have proven to be utterly good for nothing under fire influence. It would be prfitless to specify them. But how can one expect a material to be fireproof which is in great part composed of a substance known to be quite the reverse?

Common hard-burned clinker bricks passed through the ordeal unscathed, as indeed any one familiar with such materials might have expected. The same may be said of terra cotta bricks, with the exception of some which appear to be of poor quality.

Terra cotta slabs and ornamental parts in the facings of buildings as a rule were wholly unscathed by the fire influence, but there were some exceptions in ornamental work around windows and doors, where flames seem to have played upon it for a prolonged time, causing chipping and scaling off.

Fireproofing applications should be more nearly demolition proof. In the basements and lower floors of buildings, at least, they should be such as to resist all the influences which wrought destruction in San Francisco.

The one material which seems to have stood this test is concrete. Concrete walls, steps and porticos, reinforced floors and the concreting of steel columns and beams, so far as the writer has observed, have in no case been seriously injured by the heat or flame, and in all but very few cases have suffered at all seriously through demolition influences.

There have been cases where buildings have been demolished through no failure of the concrete parts, and, of course, those parts suffered with the rest, but always less than the rest. In one notable structure a considerable part of the interior was wrecked through buckling of several columns in the basement which were insufficiently fireproofed with a metal-and-plaster incasement. The building had reinforced concrete floors, and, although these were dropped down over much of its area, they held together. It is plain to be seen that they not only in great measure preserved themselves, but also prevented a more general destruction of the steel frame than did occur.

In another case some steel or cast iron interior columns were fireproofed with concrete. The building had brick walls. It went down in the general demolition, oversetting the concreted columns. But the concrete hung on, was not parted from the columns and the columns were not buckled.

EDITORIAL COMMENT

The American Society of Municipal Improvements.

The Origin of the Septic Tank.

The League of American Municipalities.

THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The approaching convention of the American Society of Municipal Improvements again calls attention to this meritorious organization. It is composed of municipal officials who are directly engaged in the construction and operation of municipal public works and public service industries and of experts in these lines who are or have been more or less directly connected with municipalities. The present requirements for membership are such that a considerable proportion are permanent members without reference to their tenure of municipal office, and in many of the cities represented those who are in charge of the technical work of construction and operation are but little affected by political changes. As a consequence, the high level reached early in the history of the association has been fully maintained and the volumes of proceedings of the society are the best collection of papers and discussions upon the various lines of municipal improvement which can be found.

That the acts of the society are accepted as authoritative is evidenced in the adoption of its standards by cities which are looking for good examples to follow. Its work on paving, electric lighting, sewerage, water supply and parks has been exceptionally valuable, both in the setting of high standards for work and in the collection of data and statistics regarding methods of construction and operation and cost of the same.

The discussion of such subjects as taxation and assessments, city government and legislation, municipal franchises and municipal data and statistics from year to year have been led by experts in these subjects and, while slightly outside the line of technical construction and operation, they have been among the most interesting subjects brought forward for discussion, and, perhaps because of their treatment by practical men, these papers have attracted favorable attention and are widely quoted.

Any city on the American continent can become a member of the society and any city official or consulting engineer on municipal work can become an individual member. Cities are entitled to as many delegates as they desire to send. Officials whose terms of office are expected to be short become members for a year or two and pass on the city's membership to their successors in office. Many engineers have been members for years through all sorts of changes in office and in titles, and some of the members of boards and councilmen of the early days of the society still retain their memberships.

The high standard of former years will be maintained in the coming convention. In fact, the statement regarding the preliminary arrangements for the program, which will be found on another page, is fuller than in former years, and the titles of papers and names of authors are such as to insure a most profitable meeting.

The association has never met so far south as Birmingham, Ala., but its experience at Nashville, some years ago, is a guaranty of the hospitality of its southern members. Birmingham is a city of progress and has more public and large private works to exhibit than any city of its size or age in the country. October is the ideal month for a visit to the south. The officials of cities which are members of the society need no further inducements to bring them to the meeting. All that it should be necessary to say to those who are not members is to call attention to the value of the meeting and the pleasures of the trip. They do not know these by experience, but this will be the most favorable opportunity to test the truth of these statements.

The convention will be held at Birmingham, Ala., beginning on Tuesday, Oct. 9, and continuing through the week. A new feature last year, which will be continued this year, is an exhibit of materials and machinery for use in municipal departments, by public service corporations and by contractors for public works.

THE ORIGIN OF THE SEPTIC TANK.

The recent litigation regarding the priority of claims regarding the invention of the septic tank has caused a general overturning of records of structures

having this general character, some of the information thus obtained having been introduced as evidence in suits for infringement of patents on processes and on machinery and methods for carrying them out.

In a paper before the Illinois Society of Engineers and Surveyors, Mr. J. W. Alvord gives a review of the evidence presented in defense of one of these suits. It includes a patent on a tank issued in Berlin in 1880, which covers the idea as well as it could be covered before the science of bacteriology had been developed. Sedimentation tanks, so-called, having all the characteristics of the modern septic tanks, were in use in England in the early systems of sewers not long after 1850. Another tank was patented in France about 1884, concerning which there seems to be no doubt that the bacterial action was recognized. Italy had two or three systems of tanks installed shortly after. Waring, in this country, made a very creditable approach to a septic tank even as early as 1876, which he had developed for domestic purposes very fully by 1894. Professor Talbot developed the Champaign, Ill., tank from the French tank, beginning in 1892, constructing the Urbana tank in 1894, designing the Champaign tank in 1895, and constructing it in 1897.

In a paper before the American Society of Civil Engineers, in 1901, Mr. Leonard Metcalf gives a detailed statement of "The Antecedents of the Septic Tank," describing Austin's English Parliamentary report in 1852; a Darbyshire, Eng., school cesspool of 1858; a settling tank at the Worcester, Mass., hospital for the insane of 1876; Mouras' French automatic scavenger of 1881; the double receiving and settling tank of the Lawrenceville, N. J., school for boys, of 1882; the Concord, Mass., reformatory sewage disposal system of 1883; Philbrick's suggestion of a system closely following the septic tank process in his description in the same year; Medfield, Mass., settling and filtering tanks of 1886; Pagliani's Italian development of the Mouras system in 1891; Gardner, Marlboro, Wellesley college and Massachusetts Agricultural college, all in Massachusetts, in 1892 and 1893, and the Champaign and Urbana tanks of 1894 to 1897.

In the discussion of Mr. Metcalf's paper, Mr. Rafter called attention to the state hospital septic tank at Central Islip, N. Y., of 1889 or 1890, and Mr. James Owen to tanks of his own construction about 1897. Mr. Metcalf also named, on authority of Charles C. Brown, tanks at Stamford, Round Lake, Bath and Batavia, N. Y., which acted more or less as septic tanks and were constructed in 1890 to 1893. That at Stamford was a part of a plan for a chemical precipitation plant, but, as constructed, was a true septic tank, which has been operating successfully ever since. It was designed and recommended by Mr. Brown.

Patents on processes and machinery for operating sewage purification plants have been granted in this country at intervals since 1882, the earliest patents having expired. So far as processes are concerned, the practical question seems to be as to whether a plant operating without full knowledge of the details of the process is an infringement of a later patent, fully describing the process, or makes the patent invalid. This question in its legal form with the modifications due to the special conditions of the suit and the adroitness of attorneys is now before the courts for decision. Patents on machinery are patents upon details and each one must stand upon its own merits, but a patent upon the process must stand upon broader grounds and must show a clear field. It has been the opinion of engineers for some years that there were enough examples of independent use of septic processes to prevent the application of a patent upon the general principles. There may, however, be valid patents upon special arrangements of apparatus and machinery. The outcome of the present suit, if our understanding of its scope is correct, will settle the question of the patentability of the general process of septic tank treatment of sewage.

THE LEAGUE OF AMERICAN MUNICIPALITIES.

The League of American Municipalities is an organization similar in some respects to the American Society of Municipal Improvements, in that it considers municipal problems and that both are made up largely of municipal officials. There is no conflict between them, however, for the problems which the two societies consider are so large that there is plenty of room to take several points of view. The one society considers the technical side of municipal activities and the other what may be termed the legislative and general administrative sides. Mayors and councilmen predominate in the League, while boards of control and engineers predominate in the A. S. M. I.

The League holds its next convention in Chicago, September 26, 27 and 28, and that city has promised a welcome which will be memorable.

The programs of the two societies, so far as they have been prepared, will be found elsewhere in this number of MUNICIPAL ENGINEERING, and will show the differences in their treatment of municipal topics. Both are doing valuable work and many municipal officials will find it advisable to attend both conventions. Those who cannot go to both will find some guidance in choosing which to attend by studying the programs offered and by writing to the respective secretaries for detailed information. Every official should belong to one or the other, the engineer, member of board of works, water commissioner or other head of practical work probably finding his best place in the American Society of Municipal Improvements, which meets two weeks later.

THE QUESTION DEPARTMENT

CITIES OWNING ASPHALT PAVING PLANTS.

Will you please inform me how many and what cities own asphalt plants?

W. D. C. LLOYD,
Louisville, Ky.

Detroit, Mich.; Winnipeg, Man.; Hamilton, Ont.; Omaha, Neb.; Pittsburg, Pa.; Allegheny, Pa., and Montreal, Que., have, or have had, municipal asphalt plants, some of them used only for repair work.

STRENGTH OF CEMENT AND TESTS THEREFOR.

Can you, through your question department, give me any information as to the crushing and breaking tests for cements; also what instruments are considered the best and most up-to-date to apply these tests; also the makers of these instruments and probable cost? We contemplate doing considerable cement work in our city, both sewer and sidewalk, and feel that any information and tests we can apply would insure us better work. G. L., Iowa.

The strength of cement varies according to the age of the test piece, the proportion of sand mixed with it and even the amount of water used in mixing. The "Handbook for Cement Users" ($3), gives full specifications for cement and descriptions of methods and apparatus for testing cement. A good specification given in that book requires 475 pounds per square inch tensile strength for a test briquette seven days old, and 550 pounds when twenty-eight days old. If mixed with one part cement and three parts sand, the respective tensile strengths are 150 and 250 pounds. Samples may be taken and sent to testing laboratories if apparatus is not at hand, but an outfit for testing the fineness and the tensile strength of cement is not expensive, and a city which is doing much cement work can well afford to purchase it. Reference may be made to the business directory published in each number of MUNICIPAL ENGINEERING, under the heading "Cement Testing Machines" for names of manufacturers.

MAKERS OF SEWER CLEANING TOOLS.

If you know of any one who is in the market with sewer cleaning tools for 15-inch sewers and under, I would like for you to notify me or them to write me at their earliest convenience, as we are in ned of something in that line. I have received word from the Stewart Sewer Cleaning Company, but would like some one else.

J. L. S., Jacksonville, Ill.

In addition to the firm named, Harold L. Bond & Co., 240 Pine street, Boston, Mass., and P. J. Healey & Co., 10 Tremont street, Boston, Mass, make sewer cleaning tools.

INFORMATION ABOUT CEMENT BLOCKS.

Does your book on cement work treat of cement blocks on the:

(1) Paint for preventing moisture going through the walls?

(2) On the point of relative strength of walls as compared with brick?

(3) As to two-piece block as compared with one-piece block for protection from water and frost?

J. E. EVANS,
Emporia, Kan.

The "Handbook for Cement Users" ($3), describes methods of making concrete and cement blocks waterproof. It gives some data regarding the relative strength of concrete and brick work. It

does not compare the two methods of block construction named. There are so many forms of each that no detailed comparison could be made in a book of reasonable size. Full discussions of principles and practice are given which should enable one to answer any question of detail for himself without difficulty.

BOOK ON CONSTRUCTION OF PORTLAND CEMENT PLANTS.

We should also be pleased to have you inform us what you consider the best book upon the construction of Portland cement plants.

D. C. & WM. B. JACKSON.
Madison, Wis.

There is no book in English which goes into detail regarding the construction of Portland cement plants. The latest edition of the "Handbook for Cement Users" ($3), has a chapter by a cement manufacturer giving the principles and some descriptions of the apparatus for making Portland cement. The earlier editions of the "Directory of American Cement Industries" ($5), give short descriptions of nearly all the Portland cement plants in operation in this country. Lathbury and Spackman's "The Rotary Kiln" ($2), gives some description of plants of their design with illustrations of the apparatus used. Eckel's "Cements, Limes and Plasters" ($6 net), gives the fullest description of the standard methods of making Portland cement which appears in any American book. Naske's ' 'Die Portland-Cement-Fabrikation" goes into great detail in describing German methods of making cement.

TARRED MACADAM ROADWAYS.

I am much interested in your articles on tarred macadam and your editorial comment on the same.

I believe the practice in the future will be to provide the best road base possible, be it macadam, gravel, cinders or clay, and then coat the surface of the same with tar or liquid asphalt to make waterproof and prevent ravelling and fraying.

Last year we used approximately twelve thousand barrels of liquid asphalt, or "road oil," it is called. The word oil, however, is a misnomer, as there is no oil about it. It is liquid asphalt, as you can see by the analysis:

Road oil, specific gravity at 60 degrees F. is 0.9955 equal to 10.5 Be., containing 85 per cent asphalt "Soft D" of 100 degrees penetration, Dow.

We have used this liquid asphalt on all classes of walks and the success has been in proportion to the base used. If macadam base no possible fault could be found with it. It is noiseless, dustless, waterproof and the traction over it easy, a load weighing 7,000 pounds, plus wagon, leaving no mark; the same load going to a softer base, gravel, left a perceptible mark and on natural earth base quite a furrow and marked increase of draft.

The carpet of asphalt protects the base and wants to be as thin as possible and still act as a carpet. The base carries the load and the better the base the better it carries the load without injury to itself.

We obtain our road oil from the Sunset Road Oil Company of Bakersfield, and it is either the slowly sundried oil of the Sunset oil district or the oil as it comes from the well with the tops taken off, as most of that oil is about 13 degree Be. gravity as it somes from the well.

I think liquid asphalt is more durable than coal tar, but both are working along the same lines and the experience gained from one may be applied to the other.

A. P. CAMPBELL,
City Engineer.
Riverside, Cal.

Mr. Campbell's experience corroborates the statements made in the July and August numbers of MUNICIPAL ENGINEERING regarding the experiments with Tarvia in Tennessee and in New Jersey. The article regarding roads in England treated with tar and asphalt found elsewhere in this number, gives some additional data, though not so definite in their statements and their conclusions as the former articles and Mr. Campbell's latter. The article on automobile tests of various pavements shows that macadam is the best pavement for automobile driving, except for the dust. If the treatment with Tarvia or liquid asphalt will remove this objection without injuring the traction on the surface, a rapid development of the use of these materials may be confidently expected.

COST OF ENCLOSED ARC LIGHTING.

I shall be obliged if you will advise me where I can find data on cost of enclosed arc lighting to cities which have municipal plants.

G. W. LEE,
Brookline, Mass.

The cost of light in Massachusetts cities is reported each year in the annual reports of the Board of Gas and Electric Light Commissioners of Massachusetts, whose office is in the State House in Boston. The report for 1905 has been issued very recently.

METHOD OF STRIPPING CLAY FROM SAND BANK.

The correspondent in the August number of MUNICIPAL ENGINEERING inquires for a cheap method of removing the clay overburden, in order to get at a sand bank. I write to say that we have installed, and are working successfully, a hydraulic plant, for the purpose of moving earth cheaply. If your correspondent can get water conveniently and his over-

burden is not too stiff clay, he can probably remove it by hydraulic process at from 5 to 8 cents per cubic yard. If he would like to correspond with us on the subject, we should be pleased to give him any information we may have that might be useful to him.

ROLAND PARK COMPANY,
EDWARD H. BOUTON, President.
Roland Park, Md.

CONCRETE WATER PIPES.

I am looking for information concerning concrete for water pipes. I have been referred to your magazine. Have you published anything concerning methods of manufacture, thickness, bursting pressure, etc.?

GEO. LEVISCONTE,
St. Cloud, Minn.

An article in this number on "Reinforced Concrete Pipe" describes one method of manufacture. Three lengths of this pipe laid together and the two ends closed have stood an internal water pressure of 35 pounds to the square inch without sign of injury, while there was some leakage at 40 pounds, which did not appear at the joints. A report of some tests on reinforced concrete water pipe will be found in vol. xxix, p. 353. Seventy feet head is recommended as a maximum, though 100 feet can be carried by short pipes.

MAKERS OF ORNAMENTAL FOUNTAINS.

I wish to install in one of our city parks a memorial fountain of moderate cost, and would be glad if you could advise me as to the names and addresses of any firms handling this line of work.

I. W. S., Alexandria, La.

Following are names of firms who will probably be able to supply fountains in metal: Bethlehem Foundry and Machine Company, South Bethlehem, Pa.; Cahill Iron Works, Chattanooga, Tenn.; James M. Carr, 319 W. Clay street, Richmond, Va.; G. A. F. Hinderer, 1112 Camp street, New Orleans, La.; Illinois Malleable Iron Company, 30 W. Monroe street, Chicago, Ill.; J. L. Mott Iron Works, 88 Beekman street, New York city; Ornamental Iron and Wire Company, Portsmouth, Va.; Stewart Iron Works, 714 E. Third street, Cincinnati, Ohio. A stone fountain should be designed by an artist and worked out by a stone cutter.

FOUNDATION FOR CEMENT WALK.

I see in MUNICIPAL ENGINEERING, just received, specifications for sidewalk of concrete calling for 16 inches excavation. Parties from outside here, who seem to be responsible, urge that 4-inch concrete walks can be laid to stay on our clay soil without excavating. We have over 2,000 lineal feet of such walks to decide on for construction this fall; if all such claims must be considered spurious, a word from you by return mail, if you can afford it, will be very much appreciated.

Very little of this work has been done here as yet, but it is coming in, and is rather essential that it start right.

C. E. VAUGHN,
East Palestine, O.

This subject was quite thoroughly discussed, pro and con, in MUNICIPAL ENGINEERING for February, March, April and later, 1905. The general conclusion of the discussion is that a wet subsoil will cause heaving of a walk by freezing, a very small quantity of water in a close grained soil causing appreciable movement. A dry soil which will keep dry is a sufficient foundation for a walk. A trench in which water will gather, from lack of drainage, is a detriment, unless it is deep enough to get below frost line, because it will confine the water and permit it to freeze and lift the walk. The specification quoted is intended to secure perfect drainage down to frost line. In clay soil it must be thoroughly drained or it is worse than no foundation. All that can be said in reply to the direct question is that a foundation of porous material, thoroughly drained, is safer than laying a walk on the surface dition of the soil which are bound to occur in any considerable length of walk, although, undoubtedly, walks have been laid successfully without foundation.

MUNICIPAL MATTERS IN COURT

Pittsburg Vapor Light Contract—Memphis Garbage Dump Enjoined—Chicago's Wide Tire Ordinance—Saginaw Gas Rate—New York Gas Rate—Baltimore Paving Cases.

Pittsburg Vapor Lighting Contract Void.

In an opinion handed down in common pleas court No. 1, by Judge J. R. MacFarlane, in the case of Harry C. Sawyer vs. the City of Pittsburg and F. M. Bigelow, former director of public works, the injunction against the city of Pittsburg, which makes void the contract for street lighting entered into with the Welsbach Street Lighting Co. of America, is made permanent and final. Judge MacFarlane finds the Sun Vapor Light Company, which was one of the three bidders for this contract, and which company bid a higher figure than the Welsbach Company, is a subsidiary concern of the Welsbach Company, as was proven by that company's own testimony. In his conclusions of law Judge MacFarlane states that this fact voids the contract, and the preliminary injunction is, therefore, made final.

Garbage Dump Enjoined at Memphis.

An injunction bill was filed in Chancery Court, August 15, temporarily enjoining the city of Memphis, Tenn., and Dr. Raymond, president of the City Board of Health, from establishing a garbage dump on the river bank adjacent to the site of the Phoenix Cotton Oil Company's plant.

Saginaw, Mich., 90-Cent Gas Rate in Court.

The city of Saginaw, Mich., has filed its answer to the bill of complaint in the case of the Saginaw City Gas Company vs. the City of Saginaw. The answer was in the form of an answer and cross-bill and asked the court to issue an injunction to compel the company to live up to the 90-cent rate which was fixed by the Common Council. The city claims that in the year 1901 the Common Council fixed the price of gas for a period of five years from June, 1901, at $1.40 per 1,000 cubic feet for illuminating, and $1.20 for fuel, with a reduction of 20 cents if paid before the twentieth day of the following month; that the Common Council had no authority to fix a higher rate for illuminating gas than for fuel gas; that at a meeting of the Common Council held June 13, 1906, a 90-cent rate was adopted by a vote of 18 to 1, in full accordance with the law, and the Saginaw City Gas Company has no lawful right to refuse to comply with the same. The defendants also denied the fact that 90 cents per 1,000 cubic feet was below the price charged in other cities similarly situated. They admit that the amount of gas used in the eastern taxing district is over 100,000,000 cubic feet, but denied that if compelled to furnish gas at the 90-cent rate the loss to the gas company would be over $10,000 each year. They claimed that at the 90-cent rate the amount of gas used would be greatly increased; that 90 cents was a fair and just rate and that for the last five years the cost of manufacturing gas has not exceeded 60 cents per 1,000 cubic feet for both illuminating and fuel gas, and such cost at this time is far below that sum. The defendants also prayed that bill of complaint be dismissed and denied that the gas company is entitled to the relief asked.

New York's 80-Cent Gas Rate Sustained.

Justice Giegerich, of the New York Supreme Court, has granted an application by Clarence J. Shearn for a peremptory writ of mandamus to compel the Consolidated Gas Company to supply gas to Dionegi Robechi, Mr. Shearn's client, at the statutory rate of 80 cents a thousand cubic feet. Justice Giegerich, in granting the motion, swept aside the contention of the Consolidated Gas Company's counsel that the 80-cent rate fixed by the new law

would prevent the company from paying dividends on its stock, and that, therefore, the law was unconstitutional because it would deprive the company's stockholders of their property. Justice Giegerich said:

As I construe this defense, taken as a whole, the company does not allege that the 80-cent rate permitted by statute will not enable it to earn enough to cover all the amounts referred to in the second paragraph, to wit: the cost of manufacture and distribution; a reasonable allowance to offset depreciation; cost of changes in machinery; and to make good the loss arising from abandonment of portions of its plant; and a reasonable profit on the fair value of the property owned and used by it in its business; but that such a rate is not enough to cover the amounts just enumerated, together with a return on the original capitalization which it apparently claims the right to pay in perpetuity under contract with the State, although the value of the property then in existence, and even of that property and the franchises and rights all combined, may have depreciated very materially since 1884.

By alleging a contract right, and by basing its allegation of fact in part upon such alleged right, the respondent, in my view of the law, fails to present any question of fact. I hold against the contention that the respondent is entitled to charge such a rate as to pay in perpetuity a return upon an original capitalization, which, so far as is alleged, may no longer be based upon either tangible or real value; its stockholders being entitled to a reasonable profit upon the actual value of the plant and property of the company, but not on such value plus the amount of some former capitalization.

Enforcement of Chicago's Wide Tire Ordinance.

Warrants are being sworn out in Chicago against officers of concerns charged with the violation of the wide tire ordinance, in an effort to prevent the streets from being further damaged by being cut to pieces by narrow-tired vehicles transporting heavy loads over asphalt and macadam thoroughfares.

Decision of Baltimore Paving Cases Opens Way for Much Work.

The Court of Appeals handed down an opinion at Annapolis, Md., August 8, sustaining the mayor and City Council of Baltimore in the paving cases.

In the case of Frank M. Flack, et al., and Jacob H. Aull, the decree of the lower court is reversed, the injunction dissolved and bill dismissed with costs. In Nos. 97 and 98, the mayor and City Council et al. vs. William H. Gahan, the decree is reversed, the injunction dissolved and the bill dismissed with costs above and below. The opinion was unanimous and the full court holds that Section 10 of the Act of 1904, Chapter 274, is not void under Section 29 of Article 3 of the State constitution, and that under that act the commissioners for opening streets are, by virtue of Ordinance No. 16, approved March 6, 1905, clothed with powers conferred by the act, and that the said commissioners have, under the statute and the ordinance just named, full power to pave such streets in the Annex as they may deem proper without the adoption of any other ordinance designating the streets to be paved.

Second—That under the statute and the ordinance just mentioned, the commissioners for opening streets have the right to select the kind of material to be used in paving Twenty-fifth street, regardless of the provisions of Ordinance No. 165 of February, 1899, since the ordinance has no application to the pending case.

Third—That the commissioners for opening streets had the power to put asphalt block, bitulithic and vitrified brick pavements in competition with each other, and, after the bids had been opened by the Board of Awards, to select the one of the three pavements to be used, and that the Board of Awards had the power to award the contract to the lowest responsible bidder upon the kind or character of pavement so selected, even though a bid had been filed on some other material which was lower than the lowest responsible bid on the selected material. It follows that the decree granting an injunction must be reversed. The injunction is dissolved and the bill of complaint is dismissed with costs above and below. An opinion giving the reasons in support of the above propositions and the court's views on other points involved in the case will be filed hereafter.

In the W. H. Gahan et al, cases the court per curiam holds that "Ordinance No. 150, approved June 15, 1906, is valid, and the decree appealed from will be reversed, the injunction will be dissolved and the bill of complaint will be dismissed with costs above and below." An opinion will be filed later.

These opinions were filed in three separate cases, one of which, the Gahan case, attacked the validity of the Bruce-Fendall ordinance, which was an effort to provide competition among paving materials by putting different kinds of materials against each other. The ordinance provided that on one class of streets bitulithic, asphalt block or sheet asphalt could be used, or, if the prices on these materials were too high, the city engineer could do the work by day labor. The ordinance delegated to the Board of Awards the right to select for use any one material after the bids were opened.

always providing that the lowest bidder on that material was chosen. The effect of this kind of competition, as proved when the bids were opened, was to secure the lowest prices quoted for many years on various kinds of paving materials. After a long fight in the council the Bruce-Fendall ordinance was passed April 17, 1906, and bids were at once asked for. When these were opened, however, it was found that the city engineer had the power under the ordinance to select the materials for use on specific streets. This was contrary to the prevailing belief, and the ordinance was sent back for amendment, so as to place the power of selection in the hands of the Board of Awards. The amendment was made and new bids were asked for and opened. Those bids proved very low, but before any contracts could be awarded, Judge Stockbridge delivered an opinion in the Twenty-fifth street case which seemed to upset the Bruce-Fendall ordinance completely. Judge Stockbridge held that while competition similar to that provided in the Bruce-Fendall ordinance is legal, the Board of Awards has no power of selection, but must award the contract to the lowest of all bidders. Under the Bruce-Fendall bids prices on sheet asphalt were always lower than on any other material, and as the board did not want to pave all the streets with asphalt, it was decided to again reject the bids. One contract was awarded, however, contrary to Judge Stockbridge's decision, and on this contract the Gahan case was instituted, involving the right of the Board of Awards to select other than the lowest prices of all materials in competition and the right of the council to delegate to the Board of Awards the power to select the materials for use on different streets.

The Twenty-fifth street case grew out of the selection by the commissioners for opening streets, who were selected by the City Council to have control of expenditures in the Annex under the $2,000,000 Annex loan, of bitulithic for use on Twenty-fifth street. In selecting bitulithic the commissioners followed the Bruce-Fendall competitive plan, and put bitulithic in competition with vitrified brick and asphalt blocks, and then, after the bids were opened, recommended that the contract be awarded for bitulithic. This was done and the contractors got to work at once, tore up the street and had begun laying the pavement before the court proceedings stopped the work. Among the points raised in this suit were the right of commissioners for opening streets to exercise the functions of the Annex Commission, it being claimed that the $2,000,000 Annex loan act did not specificially provide this right; the right of the commissioners to pave streets in the Annex without special ordinances specifying the streets, it being claimed that the commissioners can only proceed as does the city engineer, who paves a street only when directed by ordinance to do so (the lower court held that the commissioners have the right to proceed under the general ordinance); the right of the city to select other than the lowest priced material when several materials are in competition; the right of the city to use a patented material, such as bitulithic, which is the subject of monopoly.

Judge Stockbridge rendered a decision in these cases in July, deciding without qualification in favor of the city on every point except as to the selection of other than the lowest priced materials. This decision was given in the August number of MUNICIPAL ENGINEERING.

The effect of the decision rendered August 8 will be: Twenty-fifth street injunction dissolved and work resumed at once; use of patented materials, such as bitulithic, upheld; Bruce-Fendall ordinance declared legal; right of Council to delegate to Board of Awards the power of selecting paving materials is legal; new bids for paving streets named in Bruce-Fendall ordinance to be asked for at once; commissioners for opening streets have full power to act as Annex commission, under Annex loan act; acquirement of bids of turnpikes to be pressed by commissioners; paving of other streets in the Annex to begin at once.

WATER SUPPLY

New Water Supply for Worcester—Meters and Water Consumption—East Orange Water Works—Indiana Well Waters—Operation of Cincinnati Water Works.

Worcester's Future Water Supply.*

BY FREDERICK A. M'CLURE, CITY ENGINEER, WORCESTER, MASS.

That portion of the Asnebumskit watershed which has been looked upon with contemplation as a future water supply for the city of Worcester has, upon further investigation and survey, presented many additional features that are favorable to its consideration, and has confirmed the good impression which a somewhat limited search had previously formed.

The physical characteristics of the entire area are very attractive for the intended purpose, being for the most part of a wild nature, with a very small percentage of tillable land, and with sparse habitations throughout its borders. Not the least desirable feature is its nearness to the present Tatnuck brook supply, its separation being formed only by a low and short divide, which permits the system of reservoirs to be almost continuous. The fact that its run-off is available by gravitation, and that nature has done so much to minimize the difficulties of its obtaining, makes the project appear almost ideal.

In extent the watershed comprises about 9.48 square miles, and includes portions of the towns of Holden, Paxton and Rutland. The shed is naturally subdivided in two parts: that lying nearest to the Tatnuck brook comprises about 1.8 square miles, and includes a small pond known as Kendall reservoir. The waters of this portion of the shed flow northerly and join the waters of the main stream at Eagle Lake. Its basin is a fairly generous one, and offers opportunity for an initial development, being sufficient for the impounding of its own waters and a part of the main stream, which can discharge into it by means of a canal.

The principal part of the shed on the main brook itself has two points that offer practicable locations for the main dam and reservoir, but the more suitable one of the two I believe to be at the site of the present dam and basin, known as the Pine-hill reservoir. This location offers superior advantages for the construction of a dam and reservoir, by reason of the comparatively short dam required, and the excellent basin there existing. The underlying bed rock is at favorable depths, and the materials for construction conveniently located, and from a careful examination of the surroundings, I believe this site the more desirable one to consider.

It may be asked: "Why not build one large dam and reservoir for conserving all the water?" Attention was given to such a project, but sufficient basin capacity at the Kendall reservoir site does not exist, and a dam at that point is necessary in order to utilize the adjoining shed to advantage. By reason of this detached area from the main stream, it is more convenient and practicable to impound the waters separately, and to place the main dam for the larger portion of the shed at a more suitable location, where the basin necessary to its proper conservation can be found.

Thorough surveys of the several locations for the proposed works have been made, and many borings to determine the nature of the underlying strata obtained, and in each instance favorable conditions were encountered for carrying out the work as here recommended. After a careful study and consideration of all the facts, I believe the dam and reservoir at Kendall pond should be first considered, and I recommend the construction of an impounding reservoir upon this site, with dam of sufficient height to flow to elevation 814. As recommended, this reservoir will have an area of 171.82 acres, and a length of 1.45 miles.

Its available capacity will approximate 814,000,000 gallons, and its maximum depth will be 32 feet. The level of the water will be a few feet above the summit of the Tatnuck brook divide, and a dike at this point will become necessary. A gate-house for the control of the water is a feature of the dike, from which a concrete conduit 48 inches in diameter

*From a report to the *Worcester Magazine*.

will deliver the water into a discharging pool immediately before its union with Tatnuck brook.

This point is about one-fourth mile above Tatnuck brook reservoir number 1.

The main dam will be situated at the northerly end of the reservoir, with a waste weir 35 feet in length discharging into Eagle Lake. The dam will be 1,100 feet in length, and should be provided with a valve chamber for emptying the reservoir when desired. The area to be flowed by the reservoir should be thoroughly cleared of all matter that may impair the quality of the water so that the present high standard of supply may be maintained.

It is also recommended that the waters of Asnebumskit brook be diverted by head works situated upon the stream, the flow line of the diverging dam to be at elevation 822. An overfall dam at this point will be required, with suitable bulkhead, sluice gates and other appurtenances for its proper control. From the head works a canal some 2,700 feet in length will convey the water to the Kendall reservoir, to be discharged in thin vein by a weir running parallel with the canal, by which means abrasion and wash may be avoided.

It is recommended that the primary dam at Pine Hill be constructed to flow to elevation 902, which will give a reservoir capacity of about 2,000,000,000 gallons, and an area of 299 acres. The maximum depth of water at the dam will be 55 feet, and the waste weir will have a length of 75 feet. The water will be discharged through suitable appliances into the natural stream, and flow thence to the head works and canal for disposition.

Two designs for a dam at the Pine Hill location have been made, one an earthen structure and the other of cyclopean concrete. The locality is very favorable to the latter form of construction, and is well adapted to the site selected. Its cost also estimates somewhat less than the earthen dam, and from the nature of its foundations and other features pertaining to its construction, I believe it is the preferable form to use.

The development of the Asnebumskit stream as herein recommended will make a decided addition to the present water supply, and with the increased storage previously recommended upon Tatnuck brook, should amply supply a population twice that of the present.

The plan herewith presented does not require the completion of the entire project for some years to come, but can be built from time to time as circumstances demand. I believe, however, that the Kendall reservoir, together with the canal and head works, should be constructed at once, in order that its storage and the run of the brook can be diverted into the present supply when occasion requires. By the building of the conduit, with the canal and their accessories, the waters of the main stream can be turned into Tatnuck brook through the present Kendall pond, but lacking the proposed storage would be greatly minimized in value when needed.

If, however, it should be thought wise to advance the work no faster than the revenue of the water department will permit, then I believe this course of procedure the best, to be followed by the building of the dam at Kendall reservoir.

With this work accomplished, the storage conditions will then be such that the raising of the Tatnuck brook dam number 1, as proposed by a previous report, can with safety be carried out when deemed necessary, and the full value of that stream utilized. This form of procedure will defer the construction of the larger dam and reservoir at Pine Hill for many years, and make possible the storage needed to safely meet periods of diminished rainfall.

The generous storage facilities offered by the project herein recommended will greatly reduce the cost of the impounded water as compared with that of the present system, the reservoir cost of which, per million gallons stored, amounts to $515, whereas by the proposed project its cost estimates $400 per million gallons.

The estimate of cost in accordance with the terms of the within order of the city council is: Aqueduct to Tatnuck brook, with appurtenances, $86,511; Asnebumskit canal with head works, $62,002; Kendall dam and reservoir, $443,441; Pine Hill dam and reservoir, $534,504; total, $1,126,458.

Detail plans of the various features pertaining to the work have been prepared, and are on file in the office of the engineering department.

Effect of Meters on Water Consumption.

Data on water consumption in other cities are being secured by L. P. Youngs, superintendent of the municipal water system at Seattle, Wash. The installation of water meters has resulted in a great saving of water, to the entire satisfaction of the patrons of Los Angeles, Cal., and Sioux City, Iowa.

The water superintendent of Los Angeles says:

We have 13,000 meters installed, the effect of which has been, notwithstanding the great increase in the population of the city, now estimated to be not less than 230,000 people, we still get along with very little more water than we used when the population was only 125,000. It can also be said that there is no complaint of water shortage.

The water superintendent of Sioux City says:

Our water system was installed 22 years ago with two pumps having a capacity of 1,250,000 gallons each per day. With a population of 7,500 we had 120 meters installed and the use of water was decreased to 1,125,000 gallons for each pump. In 1905, with a population of not less than 45,000 we had 3,200 meters in use and the system was operated with the same pumps delivering 1,250,000 gallons each. This is about 35 gallons per capita. The patrons are satisfied with the operation of the system, which we would have been compelled to enlarge several years ago only for the meters.

East Orange, N. J., Has New Municipal Water Works.

The annual report of Arthur A. Reimer, water superintendent of East Orange, N. J., tells the result of that city's first venture in the municipal ownership line. He states that while the last year is the third year of municipal ownership of the city water system, it is the first year of operation of the new system that now supplies the city from White Oak Ridge, it having been put into service January 13, 1905. The collection of pertinent data since Mr. Reimer assumed directorship has proved a strenuous task, but was systematically followed up, with the result that the data of the system are about complete, though the placing of the information in permanent form as maps still remains to be done. To secure the necessary data a large expenditure of money was involved, as many of the gate boxes had been buried and no identification marks left, and days were often required to find one point.

The report was delayed, due to the use of a new auditing system which has been installed by Loomis, Conant & Co., of New York City.

Bad Well Water in Indiana Towns.

An analysis of 200 samples of water taken from different parts of Indiana has been made by Prof. H. E. Barnard, chemist for the State Board of Health, who finds that the well water of the State is bad—so bad that it is no wonder that typhoid fever prevails to an alarming extent. The samples were brought from private wells over the State. Shallow wells were found to be the worst, and of this class the chemist found 65 per cent. unfit for use because of pollution by sewage, barnyards and outhouses. The analysis showed that of the wells extending through what is known as the "impervious layer," 50 per cent. produce pure water. The "dug" well of from 10 to 20 feet depth is the dangerous one, says Prof. Barnard, and particularly if it is located within 100 yards of a barnyard, sink or outhouse. He says:

The use of water from shallow wells in the village or city should be abandoned. Whenever the population of a given area all around exceeds two families per acre all ground water that is not between clay and hardpan is liable to serious pollution by filtered sewage.

He stated that the examination from the wells in Liberty, Indiana, where typhoid fever raged last summer, showed a wretched state.

The Laboratory of Hygiene, of which Prof. Barnard is in charge, is securing information regarding the public water supplies of the State.

Who Shall Operate the New Cincinnati Water Works?

In a communication to the Board of Public Service of Cincinnati, August 8, John W. Hill, chief engineer of the old water works, questioned the legal right of the water works commissioners to operate any part of the new water works, as they propose to do. He says the law gives the new water works commissioners no power to operate or maintain a water works, and that if they assume the power to operate any part of the new works, and supply water to the pipes and old reservoirs, they would be legally empowered to operate the whole; and in doing so they would thus perform about all the material functions of the Board of Public Service with respect to the public water supply, excepting the collection of rents. He further says:

Whenever the the commissioners of water works pump water into the distributing mains or into the reservoirs within the city limits they will then be performing a duty which legally devolves upon the Board of Public Service.

The promise of the commissioners of water works to pump a part of the supply, with no obligations to maintain such supply, will compel the Board of Public Service to maintain each of the present pumping stations with a full complement of men, with boilers under steam and banked fires, ready to take up the service and pump the supply whenever the contractors for the various pumping engines, for any reason, should feel compelled to temporarily discontinue the daily service.

Referring to the reason given by the Board of Trustees, "Commissioners of Water Works," for not surrendering to your board the several pumping engines

as rapidly as each is ready to run and pump water into the mains and thus give the citizens of Cincinnati the opportunity, and as I believe the right, to operate such machinery through the board legally constituted and required to furnish the daily suply of water, I do not regard such reason as good. There will be no more embarrassment in finishing and starting the remainder of the pumps and other machinery if the Board of Public Service is in control of and operating the finished machinery than if it is in control of the Commissioners of Water Works. Nor can the daily use and management of such finished machinery by your board to supply water to the people of Cincinnati have any influence upon the contract conditions entered into by the Commissioners of Water Works and the respective contractors.

The completion of one pumping engine and its battery of boilers, feed pumps, etc., constitutes a unit of the new works, which, like certain finished water mains, can be surrendered for use to your board without embarrassment of contractors or otherwise. The period of use before the contractor is released from his obligations applies to lines of water pipe as well as to pumping engines, and it is not clear upon what principle the Commissioners of Water Works can surrender to the Board of Public Service water mains subject to six months' probation, and refuse to surrender pumping engines subject to a year's probation.

ROADS AND PAVEMENTS

Automobiles and Pavements—Chicago Freight Tunnels—Cost of Street Cleaning—Street Railway Franchises in Illinois—Dust Laying with Oil—Milwaukee Streets—Tarred Roadway in Washington—Comparison of Paving Materials—Macadam and Automobiles.

Best Pavements For Automobiles.

A series of road tests have been recently conducted by the E. R. Thomas Motor Company, near its Buffalo plant. A car was set aside for experimental purposes on various kinds of roads. A brick pavement was selected as the standard, and a car was geared low enough to be capable of making just a mile a minute on the selected course. The car was run over this measured brick pavement distance, to prove that this speed was uniform, and was then taken over a measured mile of asphalt. A dirt road was then tried, and then a stretch of macadam, with the following result: Brick pavement, 1:00; asphalt pavement, 1:02; dirt road, 1:05; macadam road, :58 2-5. For speed the macadam pavement was better than the other three, but for absence of dust the brick pavement proved the best. Observations show that the macadam pavement, unless oiled or sprinkled, is more dusty for all classes of travel than the brick pavement.

Chicago's Freight Tunnels Begin Operation.

Officials of the Illinois Tunnel Company, of Chicago, announced, August 14, that the freight bores of that company would begin carrying merchandise of all kinds in carload lots for the first time August 15. This movement marks the practical completion of the Illinois Tunnel Company's system of underground freight railroads, the construction of which was begun five years ago, and which has cost the owners about $60,000,000.

Cost of Street Cleaning, Garbage and Light in Cleveland.

Statistics furnished an eastern publishing house by W. J. Springborn, director of public service at Cleveland, Ohio, show 315 miles of paved streets and $191,650 as the cost of cleaning them this year; $66,000 as cost of garbage collection; 402 miles of completed sewer; lighting expenses, $195,000 for gas, and $92,000 for electricity.

Compensation For Street Railway Franchises in Illinois Cities.

The proposed laying of a double street railway track on North Main street, Bloomington, Ill., brought out considerable discussion, and in order to have some definite idea of what other cities do in such instances, the *Pantagraph*, of that city, telegraphed to fourteen different city clerk in Illinois, as follows:

"What length of franchise does street railway have in your city, and what compensation does company pay to city for same, in cash and otherwise?"

The query, which was sent to cities of near the same class of Bloomington, so that the conditions might be presumed to be about the same as in that city, brought the following answers:

Danville, population, 18,000—Street railway franchise, thirty years. No compensation to the city.—J. Torrance, city clerk.

Springfield, population, 46,000—Utility company claims sixteen years yet on twenty-year franchise. Claim is disputed by the city. The courts will decide. No compensation received, except paving between tracks.—Frank T. Reid, city clerk.

Peoria, population, 65,000—Peoria, Bloomington & Champaign Traction Company has twenty-year franchise, for which they pay special license privilege yearly, as follows: First five years, $500 yearly; second five years, $750 per year; third five years, $850 per annum; fourth five years, $1,000 per year.—Robert Joos, city clerk.

Galesburg, population, 21,000—Length of franchise of street railways, twenty years; compensation, use of poles.—L. F. Brown, city clerk.

Rockford, population, 25,000—Franchise twenty-five years from 1898; no compensation to city.—H. C. Scovill, city clerk.

East St. Louis, population, 50,000—Fifty years' franchise for $10,000 cash for street improvements.—City Clerk.

Alton, population, 20,000 — Twenty years; compensation, none—George Gray, city clerk.

Elgin, population, 25,000—Twenty years to Elgin and Chicago; cash, $10,000; other railways, no compensation; carry free police, firemen and other officers; sprinkle streets from May to November; remove snow; paid one-fourth cost of new bridge at Chicago street, $11,000; pay license of $10 on each car.—William F. Sylla, city clerk.

Joliet, population, 40,000—The Chicago & Joliet Electric Railroad Company got a fifty-year franchise in 1898; no compensation. Same company got twenty-year franchise for line into city Park July 17, 1899; compensation, $5,000. Joliet & Southern Traction Company got fifty-year franchise, April 23, 1906; will pay city $5,000 cash in year installments of $1,000; will also build two new iron bridges across Des Plaines River and Illinois and Michigan Canal; cost of bridges estimated at about $35,000 each.—Matt Berschard, city clerk.

Champaign, population, 12,000 — Street railway has twenty years' franchise; agreed to pay for all pavement assessed to them and deeded to city for street purposes some private right of way; no money consideration.—C. D. Stevens, city clerk.

Jacksonville, population, 20,000—Illinois Western Railway Company obtained a franchise for fifty years from February 26 this year. The city gets no compensation whatever.—S. B. Stewart, city clerk.

Rock Island, population, 25,000—Franchise twenty years; free transportation for all city officials.—H. C. Schaffer, city clerk.

Quincy, population, 40,000—The street railway franchise granted by legislature exclusive rights for fifty years from 1865. No compensation.—John A. Berlin, city clerk.

Decatur, population, 25,000—Length of franchise for street railway, twenty years. Each car pays license of $10 per year.—Albert Leach, city clerk.

One of the most interesting cases cited above is that of Peoria, for in that city the street railway system is owned by the McKinley syndicate, which also owns the one here. The license fee spoken of in the report of the city clerk came about as the result of a compromise between the city and the company in regard to some peculiar conditions at the time of the purchase of the property by the McKinley company. The old Central Railway Company, which had been operating the lines in Peoria had entered into a contract for the use of a bridge over the Illinois River which was to be built and maintained by the city, and had agreed to pay the city $50,000 for the use of this bridge for twenty years. When McKinley took the street railway property he of course assumed this contract to pay $50,000 for the use of the bridge. But he wanted to build a bridge of his own, and had no use for the city's bridge, but he was still bound to pay the $50,000 contracted for under the old company. Finally, the city agreed to accept "annual license" amounting for the twenty years to about $15,000, and remit the remainder of the sum, or about $35,000 on account of McKinley's building a bridge of his own.

Peoria operates fifty-six cars regularly on its street railway lines, and the license provided for in the franchise ordinance is a little over $10 a car per year. In Bloomington the company pays a special license fee of $25 per car on fourteen cars, or a total of $350 per year, amounting to twenty years to $7,000. If the company paid the same rate of license in Peoria per car as it does in Bloomington its annual license would amount to about $1,400.

The sum of $10,000 cited by East St. Louis as having been paid for a twenty years' franchise, is just a little more than the McKinley company paid in one sum when its lines entered Bloomington, the sum of over $8,000 having been paid for the use of the city in widening and repaving streets as provided in the interurban ordinance. The company must also pay back to the property owners along Main street the proportionate share of the cost of the pavement already put down there in case the additional track is put down.

The cost of the improvement in making a double tracked line on Main street is estimated by the company's engineers at $20,000.

An Associated Press despatch from Detroit, Mich., recently, was as follows, Detroit being a city of about 330,000 population:

It was announced today that after months of discussion, Mayor George P. Codd and President Jere C. Hutchins, of the Detroit Railway, have agreed on the forms of a street railway franchise for the Detroit United Railway which will be submitted to the Common Council and later submitted to popular vote of the people at the November election. Under the franchise the Detroit United makes a number of important concessions, including the following: Ten tickets for 25 cents during workingmen's hours, from 5 to 8 a. m. and from 4:30 to 6:30 p. m.; six tickets for 25 cents at all other times; universal transfers on all lines at all hours; the street car company to pay for all paving between the tracks instead of part of it as at present; and the company to pay a two per cent tax on its entire gross earnings, instead of the earnings of only part of the systems as at present.

The franchise provides that all of the franchises under which the other lines of the system were built, and which expire in 1909, be extended for fifteen years, the city then to have the right to buy all the property at its real value.

Dust Laying With Oil.

The rapidly increasing use of motor cars in England has directed a great deal of attention to the best means of laying the dust which these cars raise. It is recognized that disease germs are widely scattered by the dust clouds which motor cars place in motion, and that the dust thus circulated is one of the causes of consumption and disease of the throat and lungs. Merchants' stocks are also damaged. Many protests and demands for relief have been made.

Dust raising is a nuisance of such magnitude that various civic and official anti-dust experiments have been made. While the problem has not fully been solved, the result of some of these experiments may prove of value to public authorities in America who are confronted with the same situation. There has been a great deal of discussion in England as to who should defray the expense of keeping the highways in sanitary condition, and it is strongly urged that a considerable portion of the expense should be borne by those who necessitate the outlay.

Quite satisfactory results have been secured in Liverpool through the use of oil sprinkled upon macadam roadways. The surface having the cleanest and whitest appearance was that coated with creosote oil mixed with rosin, while that covered with creosote oil mixed with tallow had the least odor. The surface covered with ordinary petroleum was the first to show the dust.

The next in order was a mixture of creosote oil with rosin and tallow, and then the hot creosote oil alone. Creosote oil mixed with pitch, cold creosote oil, and hot creosote oil mixed with a small quantity of pitch gave good results, but the latter gave a bad appearance. The heavy black oil (coal-tar waste oil) lasted slightly longer than the creosote oil and was much cheaper. The Texas crude petroleum gave the most lasting results, and portions of the road heavily coated with this oil showed a somewhat glazed surface formed of oil and dust.

From the standpoint of the wear and tear of the road surface, the oiling on the whole has proved advantageous; the wear appears to be less; the surface of the road dries more quickly after rain and the number of loose stones picked up has been reduced.

The first sprinkling kept the surface in good order for three weeks, at the end of which time it was thought advisable to re-cover the area. The good effects of the oil on the surface after a second coating had been applied had not entirely disappeared after the lapse of five weeks. The cost varied from one-half cent to one cent per superficial yard. Some complaint was made as to the smell of the oil, especially the creosote, but against this it was claimed that as long as the smell remained flies practically disappeared from premises adjoining the roads.

Oiling wood pavements in Liverpool was done in the same manner and the dust satisfactorily kept down, a result previously not obtained even by watering four times a day, and the surface of the road was maintained in good condition during dry weather without gravel. It became somewhat slippery during a rainfall, and to avoid this it was found necessary to sprinkle a little gravel on the roadway.

The District Council of Norwich has also been experimenting with the dust-laying problem, sprinkling with a calcium-chloride solution. This is made by dissolving one hundredweight of calcium chloride in 100 gallons of water. The chloride is sold at $7.29 per ton at the chemical works. The experiment was tried for fourteen days over three lengths of main road. The first cost only $4.44, as against $9.73 with water, which has to be applied daily; the second $8.59, against $20.33; and the third, $8.33, against $40.55.

The liquid appeared to change the gravity of the dust particles, preventing them from being blown about either by wind or motor cars. The roadway seemed to be bound, and in dry weather had a good surface. The liquid absorbed the moisture, and each night an amount of moisture was gained which prolonged the effect of the treatment. This reviving influence was apparent for fully three weeks after the expiration of the treatment.

During wet weather there was a tendency for the surface to work off in layers, but it quickly dried and set hard. The conditions vary so greatly it is preferable, perhaps, that the method of application should be determined by experiments in each particular district, but the result of the treatment of roads in Norwich has been most satisfactory to the surveyor of the council.—*Bangor Commercial.*

Milwaukee Streets.

An interview with J. P. Sherer, commissioner of public works at Milwaukee, Wis., appeared in a daily paper of that city August 9, on paving and care of streets. Mr. Sherer has charge of the entire section of that city lying east of the Milwaukee River, and is responsible for the condition and paving of all the streets and alleys, and the bridges and docks on the Milwaukee River, in this territory. Mr. Sherer prefaced the interview by the following statement:

It is difficult at times to take an intelligent view of what ought to be done, without seeming to cast reflection upon a former administration, or to find fault with present conditions. As much as Milwaukee has aroused herself during the past few months, there are very many things of great importance for her to accomplish, and some of these are urgent. Street reconstruction is certainly one.

Milwaukee has 532 miles of dedicated streets and about 200 miles of these are not paved with anything; simply the old dirt roads of the primitive village. Of the paving that has been done there are: 35 miles of wood, 9 miles of granite, 11 miles of brick, nearly 2 miles of asphalt and less than a mile of bitulithic material. There are, all told, 256 miles of crushed stone and gravel streets, thus making a total of all kinds of paving in the city, of 332 miles and leaving, as I stated, 200 miles without any sign of paving. Take, for instance, other cities in our class, and some much smaller, and they make vastly a better showing on paving. Kansas City has 147 miles of asphalt streets, Washington, D. C., 136 miles, and Buffalo has 228 miles. Again, Kansas City has 40 miles of brick paved streets, Toledo 84, Cleveland 161, and Milwaukee less than 11.

The question of proper paving material can never be settled in an arbitrary manner or by any one man decree. It depends upon too many conditions to be thus disposed of summarily. While the board of public works might, perhaps, have a technical legal right to say what material used. The cost varies as much owners pay a large part of the cost and they should be consulted and pleased, if possible, in the final decision as to the material used. The cost caries as much as local conditions and depends upon many things such as grading, cutting and filling, the character of the base, etc. As a general proposition, "all things being equal, I think genuine asphalt pavement with a right base, and a sufficient amount of asphalt in the wearing surface, is the most desirable pavement for this city, and the cheapest and most satisfactory in the end.

Our attention, as commissioner, has recently been called to a new material or preservative for paving, which gives some promise of improvement. This material is known as "Westrumite," and it is claimed has been used successfully in Chicago on some of the popular boulevards. It is a chemical compound, prepared to about the thickness of water, and is sprinkled over the street with a cart. Its superiority over oil and such like material, it is claimed, is found in its capacity to preserve the street, prevent dust and not to soil one's clothes in any way, after it has been on for a given time. We expect to experiment with this new material and try it out.

We find one difficulty here in getting responsible paving contractors to guarantee paving for ten years, as is generally done elsewhere, for the reason, as they explain, that people who use autos are so careless with oil as to materially hasten the wear and destruction of asphalt streets. They claim that the grease

or oil receptacles adjusted under the auto machinery do not prevent the waste and dripping of oil, for the simple reason that they are allowed to run over and are not properly looked after. Wherever one of these machines stops and stands even for a few minutes, it is claimed that the oil penetrates the asphalt, causing decomposition and decay, resulting in a hole in the street. Under these conditions contractors decline to give a ten years' guarantee, even at a considerable advance in price per square yard for laying.

One important question for us to decide in every paving contract is a material best adapted to the street to be paved, all things considered. Mistakes are often made in selecting the wrong pavement for a street, the choice sometimes being limited by the fact that the grade is too steep to permit the use of a pavement which would otherwise be preferred. Both the traffic on the street and the cost are to be fully considered. Again, a good foundation under a pavement is as essential as a good foundation under a house, likewise the drainage. We often find it necessary to call on the city engineer to determine the best material for paving certain streets, as he is the official to determine from the grade, traffic and soil which material is best suited to the locality. We sometimes differentiate pavements by calling some permanent pavements, having a concrete foundation, and others without such foundation. Our modern pavements are generally laid on a concrete foundation, and it is only on side streets or where the property can not bear the cost of a first-class pavement that cheaper pavements without concrete foundations are laid.

The various pavements now in use and being laid in Milwaukee are: Granite and quartzite blocks, Kettle River sandstone blocks, Menomonee Falls limestone blocks, vitrified brick blocks, asphalt and bitulithic, or bituminous macadam. All of these are laid on a concrete foundation six inches in thickness and are called permanent pavements. Cedar blocks laid on a plank foundation were extensively used some years ago, but their use is now growing less each year. This is a cheap pavement, stands well for a few years, then begins to get rough and irregular and absorbs filth. Repairs are hard to make, as the blocks wear so differently that at the end, say of eight years, they must be entirely removed. Yellow pine blocks saturated with creosote oil, have been used with success in recent years. They are laid close together and form a smooth and noiseless pavement. Their use, however, is restricted to grades of less than four feet in one hundred feet, as they become very slippery and dangerous to travel on steeper grades. This is the pavement on the Sixteenth street viaduct, where they give satisfaction,, as they are light and the grade is level. They wear well and really seem to harden with age. So this class of paving may be used to advantage for bridge floors on account of lightness and durability, outlasting any floor planking now being used.

Granite rock paving is undoubtedly the most durable. Fowler street has been paved with granite, in front of the railway freight house, for twenty-five years, and is apparently as good as ever. The pavement is noisy and best adapted to slow teaming of the heaviest kind. The Kettle River sandstone pavement, extensively used in St. Paul and Minneapolis, is suitable for steep gradients, as it is gritty and will not polish, giving a good foothold to horses. These blocks are the same size as granite blocks, and laid in similar fashion, but the joints are filled with a cement grout, thereby securing an even wearing of the surface. Menomonee Falls limestone pavement has been laid in Milwaukee on several streets for more than ten years. The stone is very hard and dressed to the same size as granite blocks and laid likewise. While not as enduring as granite, it is used extensively for alley pavements, but without concrete foundations and without the tar filler.

Brick pavements have prominently come into use all over the country. Many improvements in the manufacturing of the blocks and the manner of laying them have been made since they were first introduced. The block size 3x4x9 has taken the place of the small brick, and instead of laying them on a flat course or on a gravel bed, they are now laid on a concrete foundation and sand cushion. Some simply sweep sand into the joint, others use a tar filler, and still others use a cement grout. A good brick pavement should have a concrete foundation and either a tar filler or a cement grout filler with expansion joints at the curbs and at intervals longitudinally. The blocks should be made of a mixture of shale and fire clay, as the strictly shale blocks, when thoroughly vitrified, get glossy and chip off at the edges, while the other block will wear down even. The pavement, when well laid, is sanitary, can be swept and washed, stands traffic fairly well and can be used on gradients up to 6 and 8 per cent.

The asphalt pavement laid in this city is generally an artificial mixture, being composed of asphalt, sand and carbonate of lime, very little rock asphalt having been laid in comparison with the other.

The mixture is laid on a concrete foundation and consists of two courses. The first course is called the binder course and is one inch in thickness. The second course is called the wearing surface and is generally two inches thick. The binder course is composed of stone broken to a size of three-quarters of an inch and mixed with asphalt. The wearing surface is composed of sand, asphalt, rock dust and sometimes cement. Both courses are laid hot and compacted with a steam roller. As stated, the city of Milwaukee has laid about twenty-one miles of streets with asphalt. The earlier pavements having been laid with an insufficient amount of asphalt in the wearing surface, containing about 7 per cent, which accounts for its short life, while the later pavements contain from 10 to 12 per cent of bitumen and the result has been a better pavement. When properly made it makes an ideal pavement, as it presents a smooth surface, offers little resistance to traffic, is practically noiseless, and when kept clean and dry is not slippery. Its use should, however, be confined to streets with a gradient of not to exceed 4 per cent and not too heavy traffic.

Bitulithic or bituminous macadam pavements have sprung into great favor during the last four or five years. It is said that they have the good qualities of asphalt and macadam, but none of their faults. The pavement is laid on concrete foundation, having a rough surface or sometimes laid on a six-inch crushed stone foundation. On this foundation a wearing surface is laid consisting of a mineral aggregate, using hard stone, of a size from one and three-quarters down to dust which are heated and mixed with a bitumen specially prepared for this purpose and rolled solid and compact while hot. A flush coat of bitumen is then put over the surface and screenings spread thereon and again rolled. The thickness of the wearing surface is two inches. The pavement is suitable for moderately heavy traffic and can be put on streets with gradients up to 6 per cent with safety. Milwaukee has only three-fourths of a mile of this pavement.

The cost of the different pavements will vary from time to time, the average prices paid in Milwaukee having been as follows: Granite, $3.00 to $3.25 per square yard; Kettle River sandstone, $2.80; Menomonee Falls limestone, $2.00; vitrified brick, $1.75 to $2.00; asphalt, up to $2.25; and bitulithic, $2.18. This includes the necessary grading, concrete foundation and the surface, also a guarantee of five years in which the contractor makes all repairs, goes with the contract.

Experiment With Tarred Roadway in Washington.

The commissioners of the District of Columbia have determined to experiment with the application of crude tar on the roadway of Patterson street N. E., between North Capitol and First streets, Washington, D. C. This street is subject to particularly heavy traffic and it is almost impossible to keep down the dust by ordinary sprinkling with water, but it is believed that the use of tar will secure the desired effect.

Comparison of Paving Materials by City Engineers.

With a view to ascertaining the relative merits of the various street paving materials now in general use, as shown by actual experience of cities and towns throughout the United States, a list of questions was recently sent out by the Denny-Renton Clay and Coal Company, of Tacoma, Wash. The questions were designed to cover every possible phase of street paving under the tests of time and traffic. The questions were sent to municipal engineers of 100 cities and towns, with requests for complete answers. Answers were received from about 75 cities, signed by the city engineers, and these have been put in condensed form by the Denny-Renton Clay and Coal Company, who will send a copy of the same to interested parties. A summary of the reports shows the following:

Mileage of pavements in 77 cities in the United States is as follows: Brick, 845.05 miles; asphalt, 834.55 miles; sandstone and other materials, 210.42 miles.

Reports from 77 cities show that brick has generally been in use from one to 28 years; a few cases from 18 to 25 years. Average condition of brick good; not one report showing it in bad condition.

Such cities as make report on repairs (about 50 per cent) say that brick costs practically nothing for repairs for first 15 years.

In nearly all cases the test recommended on vitrified brick is the one adopted by the National Brick Manufacturers' Association, that is absorption and abrasion; a few, however, reporting that they do not require tests, relying upon contractor's guarantee for the protection of the municipality.

Fifty-one engineers report average grade practical for brick, 8 per cent.; 35 engineers recommend brick pavement as best for horses' foothold; 10 prefer granite or wood block, where there is a grade

of 6 per cent. or over, and 30 neglect to report on this point.

Average life of vitrified brick as estimated by the various city engineers:

Heavy traffic .....21 years
Light traffic .....32 years

Thirty-three engineers prefer brick for heavy traffic, one prefers macadam, and five prefer granite; balance make no report on this point.

Thirty-nine engineers report brick as easiest material to repair, one reports wood block as easiest material to repair, balance make no report.

Automobiles and Macadam Roads.

The following from a popular newspaper account of the government experiments on the effect of automobiles on macadam roads and on methods of preserving the roads gives a good general idea of the problem and of the progress which has been made toward solving it:

The automobile stands accused, on official government authority, of a high crime and misdemeanor. It is destroying the roads by carrying off the dust. By putting the matter to a practical test with automobiles at different speeds and photographing the vehicles "on the run," so to speak, some very accurate data have already been secured.

One method adopted for the purpose is to mount a photographic camera on the front of a motor car, and following close behind another automobile, to take snap shots of the latter at different speeds. It is quite a picturesque and interesting performance, the exact speeds being determined by means of stop watches held by men stationed along the track, while additional photographers are placed at intervals on the roadside, to take pictures of the machines as they fly past. The work in question is being done in the neighborhood of Washington, under the direction of the bureau of roads.

To say that dust is the life of a road is not putting the fact too strongly. It is the cementing material of the road surface, which, combining with the moisture contributed by rain, holds together the stony particles composing that surface, shedding storm water, and preventing the particles from undergoing disintegration.

Thus it may be said that dust is to a road what shingles are to a house. If it is taken away, the roadbed goes to pieces. The amount of dust thrown up by the automobile is in proportion to the speed at which it goes. But, in order to obtain exact figures on this point, the government experts take a series of photographs of each motor car, traveling over the same stretch of road, at ten miles, twenty miles, thirty miles, and so on, up to seventy miles an hour. For the sake of fairness, a day is chosen when there is only an average breeze blowing, so that the amount of dust raised and carried by the wind off of the roadway may be recorded without exaggeration or the reverse.

A stretch of road with a fairly sharp turn is chosen by preference, in order that photographers posted at the bend may, with safety to themselves, snapshoot each motor car from directly in front, as it approaches, and also directly from behind, after it has passed by. One advantage of this "end-on" point of view is that the machine does not show movement in the picture—as, of course, it would do if crossing the visual field.

For some of the snaps not more than one-three-hundredth part of a second is allowed. Now, it is not merely for theoretical purposes that the road bureau is making these experiments. It is trying to find a remedy for the mischief—a practical part of the inquiry which is being carried on simultaneously with the automobile tests above described. Something must be found, obviously, to keep the duts from being carried off of the roads, and the requisite preventive seems to be either tar or oil.

For some months past the experts have been applying tar and crude petroleum to different sections of roads, and they have found that either (though the tar seems to be preferred) accomplishes the purpose admirably. It appears that an application of tar costs less than 2 cents a square yard, including labor, and it will last for a year or so—though just how long can not be stated exactly as yet. The cost of oil is even less.

The tar is transported for the purpose in tank cars, and heated in the car by introducing a coal of steam pipe into it and furnishing the requisite heat from an engine on wheels, which is run up alongside. In this way the material is made fluid, so as to be easily spread by men with brooms or otherwise over the surface of the roadbed that is to be treated. The tar gives a hard and smooth coating, resembling asphalt.

It penetrates to a depth of one or two inches and in the case of macadam forms a sort of matrix into which the stones of the top layer are set.

A tarred street is dustless in the same sense that an asphalt street is dustless. It can be swept or washed clean. Cleaning that would soon ruin an ordinary macadam road does not injure the surface thus treated, inasmuch as the stones are not torn up or distributed. In driving

over a tarred macadam road the lessened vibration and noise are quickly noticeable, and it is claimed by horsemen that the surface is better for horses' feet. In addition the tar has antiseptic properties and its use would be beneficial both as a germicide and as a means of procuring cleanliness.

If, as seems to be the case, the automobile is a destroyer of roads, the problem (inasmuch as this type of vehicle has come to stay) is to find some means of protecting the paths of traffic against the damage which under ordinary conditions it inflicts. This is the puzzle for which the road bureau is trying to discover a solution and, though the inquiry is as yet in an experimental stage, the expectation is that the best and cheapest cure for the mischief lies in applications of oil or tar, the former having the advantage of cheapness, but the latter promising greater durability and satisfactoriness, especially for city streets.

CEMENT AND CONCRETE

Design of Reinforced Concrete—Value of Railroad Ties—Cement Imports and Exports.

The Progress and Logical Design of Reinforced Concrete.*

BY ROSS F. TUCKER, M. AM. SOC. C. E, NEW YORK CITY.

Those who are under the impression that the present popularity of reinforced concrete is largely a fad may be interested to note the progress of this type of construction since its inception in 1885, in terms of the production of Portland cement in the United States. In 1882 the output of Portland sement was 82,000 barrels. At this time, reinforced concrete was unknown, and the value of Portland cement concrete as a structural material was not dreamed of. Natural and Rosendale cements had the field practically to themselves and concrete, where it was used at all, was confined almost wholly to foundation and underground work.

In 1885, Ernest L. Ransome, then of San Francisco, invented the twisted bar and demonstrated the principle underlying all reinforced structures whereby it is possible to incorporate steel bars in a mass of concrete in such a manner as to enable the concrete to withstand transverse loads. It will be noted that at this time the production of Portland cement in the United States was 150,000 barrels. From 1885 to 1890, Ransome was engaged in applying his discoveries to works of the most elaborate and extensive character. When we take into consideration that, at that time, the subject of reinforced concrete was in a most elementary experimental stage, and that there were no accurate formulae or known valuations for determining concrete design, and that the appliances for making and handling concrete were of a primitive kind, we can appreciate the difficulties with which he had to contend, and can bestow the greater credit and honor upon him for the courage and splendid mechanical and engineering ability which he displayed in undertaking the construction of steel concrete buildings of such magnitude in a country subject to earthquakes. Among the structures above referred to are the Museum Building and Girls' Dormitory at Stanford University; the interior of Academy of Sciences, the building for the Pacific Borax Company and the Tubbs Cordage Works, and the value of his discoveries has been further accentuated by the fact that during the recent great earthquake in California all of the above structures, comparatively crude as they were in design, came through the ordeal practically unscathed, where buildings of brick and stone in their immediate vicinity were entirely wrecked. In 1890 Ransome determined to introduce his ideas throughout the country, and for a considerable time thereafter, the writer was engaged in lecturing before technical societies and architects and engineers generally on the subject of reinforced concrete and the possibilities of

*From a paper before the Association of American Portland Cement Manufacturers.

that type of structure. While these ideas were all of great interest to the technical public, they were so new to the building world at large that it was only here and there that they gained a foothold. The steel frame structure by this time had been brought to a high degree of development and architects and engineers, while interested in the possibilities of reinforced concrete, were loth to give up the steel skeleton and adopt a type of construction with which they were so entirely unfamiliar. The lesson, nevertheless, had its effect. About this time came the introduction of expanded metal and the mesh systems of concrete construction, which enabled the architects to retain their steel structures and use concrete for the filling and arch work between beams in place of brick work and terra cotta. These methods enabled the architects to use concrete in a conservative manner and to become acquainted with its structural properties without abandoning the steel frame which constituted the main structural basis of their design. In this period, from 1890 to 1895, the production of Portland cement progressed from 300,000 barrels to 900,000 barrels, and the lessons learned from the use of concrete in this respect led to its adoption in a large number of projects originally planned for other material.

From this time on the use of concrete grew very fast. In 1897 and 1898 there came a great shortage in structural steel. Deliveries were so uncertain and remote that engineers the country over were at their wits' end to find ways and means for fulfilling their designs, and they turned at once to reinforced concrete to help them out of their dilemma. European systems of reinforced concrete were introduced and engineers generally began to study the subject from a scientific standpoint, with the result that by 1900 the steel concrete structure was recognized generally as a structural possibility and its adoption was considered for every conceivable kind of problem. At this period, the production of Portland cement in this country had reached 8,400,000 barrels per annum. In the succeeding five years, however, the popularity of concrete and the confidence of the building public in its properties were demonstrated in a most astonishing manner, for the production of Portland cement sprang from 8,400,000 barrels in 1900 to 36,000,000 barrels in 1905.

Any one considering the progress of the industry, as noted, can hardly say that the reinforced structure is a fad, although it is to be admitted that concrete has been applied to many purposes for which it is not at all suitable. It is a fact now beyond dispute that the steel concrete structure has passed the experimental stage and had been adopted throughout the land as a building element of the greatest value. It is true, however, that much has yet to be done in the education of the architect and the engineer and in the use of concrete in a logical manner and for its real value. Owing to the comparative youth of this type of building, architects and engineers generally have not as yet given any great attention to the development of design essentially suitable to reinforced concrete. It is the general practice to design in brick, stone and steel and then to call upon a reinforced concrete engineer to reproduce a structure in reinforced concrete. This is an imperfect and unscientific method and unfair to the development of the true value of the concrete structure. The average architect and engineer is, as yet, too unfamiliar with the characteristics of concrete to design a structure solely from that point of view. He thinks in terms of brick and steel, designs in brick and steel and then attempts to adapt concrete to his structure. The architect who would design intelligently for reinforced concrete must think in terms of reinforced concrete, but up to the present time, the condition is similar to requiring a carpenter to think in the metric system when he has been all his life accustomed to figure in feet and inches. He must stop and translate and is unable to bring his mind to an adequate appreciation of his dimensions until he has so translated them. Reinforced concrete is a structural method possessing peculiar characteristics which are essentially its own, and any design which is to be carried out in this material should be adapted to their characteristics and qualifications. For instance, many have an idea that the cost of cement and the labor involved in the handling of concrete are the particular elements of cost in a concrete structure, whereas, as a matter of fact, the determining factor in the cost of concrete of whatever nature is the cost of the wood work and centering required for the carrying out of the design. The initial cost of a yard of concrete may be $5.00, but that same yard of concrete may be made to cost $40.00 by the addition thereto of elaborate forms necessary for the placing of the concrete in the position required in the design. On every structure projected for brick and steel, and afterwards converted into concrete, the cost of concrete will vary for every yard from $5.00 to $40.00, depending upon the

position in which it is placed and the elaboration of the forms necessary for the fulfilling of the design. It is, therefore, apparent that the greatest economy in the use of reinforced concrete is to be attained by keeping this fact in mind and designing the structure accordingly. The essence of economy in concrete work is the simplicity and duplication of forms, and this of itself demands the elimination of projecting members such as cornices, belt courses and offsets to the largest possible extent. The reinforced concrete building must be essentially a plain building and its architectural effect must be developed by the study of the relation of the openings to the masses, together with the assistance of such color scheme as may be applied by the insertion in the face of the structure of tile or mosaic work in color masses suitable to the problem.

Many of the monuments of Rome, that have endured for more than 2,000 years, were built of a concrete far inferior to that which we use today. So inferior, in fact, and so different in method and material as to be hardly entitled to the name of concrete, as we know it, at all. Still these monuments, stripped of their facings and mosaic, tile and stone by the ravages of time and conquest still endure. What, then, may we expect of the great structures which we are building under the eye of modern science? It is certain that the concrete of our day will endure far beyond the life of any natural stone and it is not too much to hope and predict that when our architects have become acquainted with the true characteristics of this wonderful material, they will create a new architecture more original and more truly American than any we have attained thus far. The future is replete with possibilities. We have learned thoroughly how to make concrete strong, let us learn now how to make concrete beautiful.

Comparative Value of Ties of Different Materials.*

BY W. C. CUSHING, PITTSBURG, P. A.

Having been approached from time to time by the inventors of different designs of concrete and steel cross-ties, the writer found it necessary to make an investigation, with a view to determining, as closely as possible, the relative value of such cross-ties, taking cost and prospective life into account, as compared with the wooden cross-ties at present in use. The following deductions are presented:

(1) With white oak ties costing 70 cents delivered on the railway, it is economical at the present time to buy inferior woods at a price not to exceed 50 cents, have them treated with zinc-chloride or zinc-tannin, lay them in the tracks without the use of tie-plates (except where it is necessary to use them on oak ties) and use a standard railway spike. A life of ten or eleven years has been found to be a maximum for such ties without the use of tie-plates and better fastenings, and if the life of ten years is not attained, there will be that much loss to the company.

(2) When a white oak tie reaches a cost of 86 or 87 cents delivered on the railway, it will be economical to use the zinc-creosote process, or straight creosote costing 30 cents, if the tie costs 46 cents delivered and will last sixteen years; or, it will be economical to use straight creosoting costing 85 cents for treatment if the tie can be made to last thirty years, which is French practice, before the oak tie reaches a cost of 80 cents delivered on the railway. In both of these cases it is assumed that tie-plates, wood screws and helical linings are used because ties cannot be made to last more than ten or twelve years without the use of proper fastenings, since, otherwise, the tie will be destroyed by mechanical wear. It is necessary, therefore, to use improved fastenings when we expect to obtain a life of ties greater than ten or eleven years. It will also be economical to use a steel tie costing $1.75 delivered, if it will last twenty years.

(3) When the white oak tie reaches a cost of 90 cents delivered on the railway, it will be economical to use either ties of inferior woods treated with zinc-tannin if a life of fourteen years can be obtained, the improved fastenings being used; or a concrete tie costing $1.50 if it will last twenty years.

(4) When the price of white oak ties reaches $1 it will be economical to use a steel tie costing $2.50 if it will last thirty years, a concrete tie costing $2.25 if it will last thirty years, or an inferior wood tie treated with zinc-chloride if a life of twelve years can be obtained.

(5) With ties of inferior woods costing 46 cents delivered on the railway we must obtain a life of from eighteen to twenty years, whether treated with zinc-chloride, zinc-tannin or zinc-creosote, to make them as economical as white oak ties costing 70 cents. It is assumed, of course, that they must have the most approved fastenings in order to attain an age as great as that.

*From a paper before the American Railway Engineering and Maintenance of Way Association.

(6) With inferior woods costing 46 cents delivered, and if the creosoting costs 30 cents, it will be necessary for us to obtain a life of twenty-one years in order to make them as economical as white oak ties costing 70 cents delivered.

(7) With inferior wood ties costing 46 cents delivered, and with the creosote treatment costing 85 cents, as in French practice, it will be necessary for us to obtain a life of thirty-six years from the ties in order to make them as economical as white oak ties costing 70 cents delivered.

(8) With steel ties costing $1.75 each delivered, it will be necessary for us to obtain a life of twenty-eight and a half years in order to have them as economical as white oak ties costing 70 cents delivered. This price is a little less than the cost of the Buehrer steel ties.

(9) With concrete ties costing $1.50 each delivered, it will be necessary for them to last twenty-eight years before they will be as economical as the white oak ties costing 70 cents delivered.

(10) With steel ties costing $2.50 delivered and concrete ties costing $2.25 delivered, which are approximately the prices of the Seitz steel tie and the Buehrer concrete tie, it is necessary for them to last over fifty years each in order to make them as economical as the white oak ties costing 70 cents delivered.

(11) In order to make treated inferior woods as economical as white oak ties costing 70 cents delivered, when the treated ties are equipped with proper fastenings in order to make them last as long as has been found practicable by experience, we can only afford to pay for the ties delivered on the railway, 10 cents each when treated with zinc-chloride; twenty cents each when treated with zinc-tannin, or creosote at 30 cents; 23 cents each when treated with zinc-creosote, and 29 cents each when creosoted in accordance with French practice.

(12) In order to make them as economical as white oak ties costing 70 cents delivered, we can only afford to pay $1.48 each for steel ties which last twenty years, and $1.79 each when lasting thirty years.

(13) In order to make them as economical as white oak ties costing 70 cents delivered, we can only afford to pay as first cost of concrete ties delivered, $1.15 each, if they last twenty years, and $1.57 each if they last thirty years.

(14) We know nothing about the life of concrete ties, and it is at least very desirable to experiment with them for yard and side tracks, even though we do not use them in the main tracks, because they might lie undisturbed in yard tracks for many more years than they would in main tracks.

(15) When white oak ties are costing 70 cents delivered (about present prices), we can afford to buy inferior oak and other hard woods at 45 cents to 50 cents (present prices), and have them treated with the zinc-tannin or zinc-chloride process, and only use common spike fastenings.

Imports and Exports of Cement.

During the month of June, 1906, 102,118 barrels of foreign cement were imported into the United States and 386 barrels were re-exported, as compared with 79,976 barrels imported and 10,162 barrels re-exported in June, 1905. In June, 1906, 52,938 barrels of American cement were exported, as compared with 109,714 in June, 1905.

In the twelve months ending June 30, 1906, 982,409 barrels were imported and 13,519 were re-exported. During the year ending with June, 1905, these amounts were 856,885 and 44,968, respectively, and in 1904 the amount imported was 1,525,730 barrels. During the year ending June 30, 1906, 809,578 barrels of American cement were exported, as compared with 1,067,284 barrels in 1905 and 362,503 in 1904.

The effects of the home demand upon both imports and exports are shown by these figures.

STREET LIGHTING

Manufacturers' Gas Price—Illinois Street Lighting Cost—Lighting and Water Plant for Orange—Cost of Electric Lighting.

Price of Gas to Manufacturers.

A recent report from Consul Albert Halstead, of Birmingham, states that the English borough of Walsall has decided to reduce the price of gas to manufacturers from 54 to 48 cents per 1,000 cubic feet. He says:

A short time ago the Birmingham city authorities reduced the price of gas to manufacturers who can use small engines to 38 cents. The tendency throughout this section of England is for the price of gas, made either by local authorities or private companies, to be reduced to manufacturers. This shows not only the trend toward an increasing use of gas for power purposes, but also a determination to meet the new and vigorous competition of the handy suction producer gas engine plant and other modern methods of gas production in individual plants for gas engine use, which has steadily grown in recent years. Already suction gas engines above 15 horsepower have practically captured the field, and the effort now is to save to the local gas authorities and gas companies the field for gas engines of from 10 to 15 horsepower. The manufacturers of suction gas engines are in turn already preparing to meet the competition of the gas authorities. One difficulty that the manufacturers of suction producer gas engines have had to meet is the fact that the successful types of these self-contained power plants, as now made, require pea anthracite or coke.

A patent has already been applied for, however, which the inventors, who are successful suction producer gas engine plant manufacturers, believe will make it possible to use bituminous coal for suction producer gas work. If this patent proves successful, there will be an immediate increase in the use of suction plants, because of the greater cheapness of bituminous coal in England. The success of this invention would be very important to many sections of the United States, where anthracite gas producers are not practicable because of the cost of the fuel. The benefit to communities in the United States where atmosphere is now blackened by coal soot that would result from the general use of gas engines need not be emphasiezd.

Street Lighting Rates in Small Illinois Cities.

The street lighting contract is causing the city of Milford, Ill., considerable dissatisfaction. The city has a population of 1,600 and pays $2,020 a year. The Milford *Herald* has been securing data from the city clerks of a number of central Illinois cities with the following result:

Gibson City—Five 1,200 candle power arcs at $7 per month, running until 3 o'clock, March 22 to September 22, and until 5 o'clock September 22 to March 22; 35 32 candle power at $1.40 per month, and 16 candle power at $1.00 per month until midnight. City gets six 32s and 12 16s and two 8s free.

Sheldon—Ten arc lights, cost $60 per month, and 28 incandescent at $42.

Momence—One hundred incandescent lights costing $120 per month. Poor service. At the meeting the first of July, a committee was appointed to take up the proposition of putting in a light plant in connection with the water plant.

Hoopeston—Five arc lights at $5.75; 132 incandescents at $1.25. Midnight schedule.

Rossville—Sixteen 2,000 candle power lights at $6.25 per month. Midnight schedule.

Onarga—Six arc lights at $6.25 during the winter, and $6 during the summer; 88 incandescent lights, 75c in the winter and 60c in the summer.

St. Anne—Twenty arc lights of 2,000 candle power at $65 per year. Midnight service and very satisfactory.

Watseka—Fourteen arc lights and 130 incandescent, cost from $215 to $218 per month.

Paxton—Thirty-five arc lights at $58 each per year. All night service and very satisfactory.

Fowler—Six arc lights and 43 incandescent, cost $113.75 per month. All night service.

Estimates for Lighting and Pumping Plant for Orange, N. J.

The Common Council of Orange, N. J., received reports relative to the proposed municipal lighting and pumping projects, August 6, from James M. Seymour, Jr., and Runyon & Carey, and others. Mr. Seymour estimates that the city could build a plant complete for $70,000, which would include street lighting as well as power for water and sewer pumping. Runyon & Carey figured on $68,000 as the cost for a lighting plant alone, and on 325 arc lights, the number now in use, while Mr. Seymour gave his estimates on 350 arc lights. He says that by using the plant for light and pumping purposes only the saving would

be sufficient in four and a half years to pay for the entire plant, but by adding an extra unit and selling power a profit of $48,000 a year would be made. By an investment of $125,000, he said, the city could light the streets, most of the houses, do water and sewer pumping and earn $39,000 a year.

Runyon & Carey estimated on a plant large enough for the three, but in the cost of operation gave figures only for the proportion which should be charged against the lighting plant. The plant proposed by them consists of two 200 k. w. electric generators directly connected to two slow-speed engines, the total capacity being approximately 740 arc lamps. The cost of property was placed at $1,500; of the building, foundations, machinery and chimney, $16,000; boilers and steam fittings, $15,000. One-half of this amount they charged to the lighting plant, the cost of which they estimated at $68,000, based on these figures:

Property, $750; building, $8,000; boilers, $7,500; engines, $12,000; generators, $11,000; switchboard, $10,000; pole line, $18,750. If underground conduits were laid in Main street the cost would be increased $11,000. They allowed $4,515 a year for depreciation and $6,672 for salaries, this being on account of the lighting plant, some of the employes being charged in part to the water and sewers. The force included a chief engineer and superintendent, two assistant engineers, three firemen, one lineman, one helper, one trimmer and one horse and wagon. They allowed $4,575 for coal, $300 for oil and waste, $813 for supplies and $300 for repairs, making the total cost of operation $22,255 a year. They figured, therefore, that 325 lamps would cost $68.48 each, a saving to the city of $5,370. It would be possible to run 500 lamps on this plant without danger and if this number was used the cost would be increased only by coal and supplies, so that the annual expense would be $25,115, the cost of each light, $50.23, the plant being adequate at the same time for the lighting of public buildings.

Cost of Electric Lighting in Cities.*

BY A. S. HATCH, DETROIT, MICH.

It may be of interest to the members to know what is being paid for street lighting in different cities, so the writer has added a list of representative cities. According to a report made at the last National Electric Light Convention, there are 4,839 central electric light plants, 3,732 private and 1,107 municipal. Seventy-five per cnet. of them are reported in the latest statistics of the U. S. Census Bureau. A summary of that report gives:

	Private.	Municipal.
The total gross income	$78,735,500	$6,965,105
The total gross expense	62,835,388	5,245,987
Profit	$15,900,112	$1,719,118

The income of the municipal plants includes the public lighting at prevailing rates. The actual cost of the lighting is secured as follows:

Total gross expense,		$5,245,987
Less the commercial income, which is:		
Arc	$ 140,116	
Incandescent	2,868,296	
Other service	216,242	3,324,704
Actual cost of public service		$1,921,283
Of this 86.5 per cent. is for arc lighting, or		$1,661,910.00
And 13.5 per cent. for incandescent service, or		259,373.00
Making average cost per lamp for 45,002 lamps		36.93
And per incandescent lamp for 82,920 lamps		3.13

This includes 12 of the largest municipal plants which have no commercial service and whose average cost was $47.15, which very materially reduces the cost for public service to those having the commercial. The data for determining such actual cost are not available on account of the methods used by the different municipalities in charging items to different accounts as pointed out by the writer on page 97 of last year's report. The kilowatt hours output per kilowatt general capacity of the plant was for private plants 2,054.5 and for municipal, 1,727. The cost of fuel per kilowatt hour was 45 cents for the former and 74 cents for the latter, and the yearly average wages paid per person was $650.00 and $576.54 respectively. The investment in private plants was given as $582,719,879 and the funded debt as $254,563,923, leaving the value of the stock as $228,155,956, or 61 per cent. of the amount issued and allowing a profit of 7 per cent. on the actual value.

The writer has endeavored to give the latest figures in the table, but if errors are found he requests that the correct amounts be given so corrections can be made. The table gives the number of arc lamps only which are used for street lighting, although many cities have incandescent and gas, and one, Great Barrington, Mass., uses incandescent only. The cities are arranged according to population and the lighting is divided into three classes: all night, every night service or 4,000 hours; all night, moonlight service or 3,000 hours; and midnight, moonlight

*From a paper before the International Association of Municipal Electricians.

service, or 2,000 hours. These with the two classes of lamps, give a basis for comparison per 1,000 candle hours, but the cost so given does not include in those cities under contract the cost for inspection or kindred service paid to city employes and directly chargeable to street lighting. The total amount for such service is given where known, but this cannot be divided by the number of lamps since in some cases it includes gas lighting also. Municipal plants are given in a separate column as cash cost only and in those doing a commercial service the difference between expense and receipts is also given. It will be noticed that all but three have a balance besides getting their public service free. That is the fixed costs of a municipal plant are the cost of street lighting plus or minus the difference, a surplus or deficit as the case may be. Tacoma, Wash., buys power from a commercial company and still has a balance on the right side, besides free street lights. Berrien Springs, Mich., for certain franchise privileges, has 25 street lamps free and 50,000 gallons of water per day pumped free.

A comparison of the population with the number of lamps shows a marked difference between cities under contract and those with municipal plants. The former runs one lamp for 200 to 612 inhabitants, while the latter are one lamp for 66 to 146. However, the contract cities use a large number of gas and vapor lamps, so the cost per inhabitant runs from 39.4 cents to $1.32 for Boston, while with municipal plants it runs from a profit of over $2.00 to a cost of 35 cents for Detroit and 32 for Chicago. An examination of the costs per 1,000 candle-hours shows Gloucester, Mass., pays the most, 2.36 cents, and Harrisburg, Pa., the least, ony one-fourth as much or .59 cents, but coal is $4.25 per ton in one and $2.50 in the other.

CITY.	Street Lamps.			Rate per Lamp.				Difference of expenses & receipts, mun. expens's more / less.
	Number.	Hours per year.	C. P.	Per year.	Per 1000 c. p. Hours.	Extra cost insp. city.	Cash cost mun.	
Chicago, Ill.	7320	4000	2000		.0067		53.58	
Philadelphia	9977	"	"	99.00	.0124	.87		
St. Louis, Mo.	1000	"	"	74.95	.0093			
Boston, Mass.	3699	"	"	120.45	.0151	.18		
Baltimore, Md.	1772	"	"	67.49	.0084	.76		
Cleveland, O.	1119	"	"	73.56	.0092	12.68		
Buffalo, N. Y.	2833	"	"	56.00	.0070	3.24		
Detroit, Mich.	3005	"	"	34.99	.0044		34.99	
New Orleans, La.	1702	"	"	69.00	.0086			
Newark, N. J.	1973	"	"	95.00	.0119	2.01		
Jersey City, N. J.	1403	"	"	97.50	.0122			
Louisville, Ky.	1803	"	"	74.00	.0092	3.36		
Indianapolis,	994	"	"	85.00	.0106			
Kansas City, Mo.	943	"	"	65.00	.0082			
Rochester, N. Y.	2886	"	"	78.47	.0098			
Denver, Col.	1253	"	"	70.00	.0087			
Toledo, O.	1197	"	"	83.00	.0104			
Allegheny, Pa.	1480	"	"		.0077		61.21	
Columbus, O.								
Worcester, Mass.	744	"	"	91.25	.0114	16.23		
Los Angeles, Cal.	1063	"	"	81.00	.0101			
New Haven, Conn.	620	"	1200	82.12	.0175	1.93		
Fall River, Mass.	789	"	2000	109.50	.0137	7.53		
Memphis, Tenn.	400	"	"	85.00	.0106			
Omaha, Neb.	478	"	"	94.50	.0118			
Paterson, N. J.	750	"	"	101.00	.0125			
Scranton, Pa.	783	"	"	86.40	.0108			
Cambridge, Mass.	554	"	2000	100.00	.0208	1.83		
Atlanta, Ga.	821	"	2000	75.00	.0094	1.83		
Albany, N. Y.	678	"	"	98.55	.0123	4.56		
Gr'd Rapids, Mich.	642	"	"		.0044		35.12	
Dayton, O.	453	"	"	68.50	.0085			
Seattle, Wash.	204	"	"	66.00	.0082			
Hartford, Conn.	809	"	1200	75.00	.0156			
Richmond, Va.	595	"	2000	60.00	.0075	7.83		
Reading, Pa.	630	3000	"	89.88	.0149			
Nashville, Tenn	642	4000	"		.0050		40.00	
Wilmington, Del.	313	"	"	64.92	.0081			
Camden, N. J.	400	"	"	120.50	.0151			
Bridgeport, Conn.	508	"	1200	83.00	.0173	.30		
Trenton, N. J.	410	"	2000	97.25	.0122			
Lynn, Mass.	302	"	"	102.20	.0128			
Springfield, Mass.	922	"	1200	75.00	.0094	1.52		
Savannah, Ga.	515	3000	1200	72.00	.0200			
Peoria, Ill.	692	4000	2000	65.00	.0081			
Duluth, Minn.	360	"	"	75.00	.0094			
Erie, Pa.	548	"	1200	58.40	.0121			

Charleston, S. C. .	205	"	"	75.00	.0156	7.82		
Harrisburg, Pa. ..	440	"	2000	47.60	.0059			
Schenectady, N. Y.	440	"	"	92.00	.0155	1.87		
Holyoke, Mass. ..	263	"	1200					21201.00
Ft. Wayne, Ind. ..	330	3000	2000	85.00	.0142			
Saginaw, Mich. ...	304	4000	"	60.00	.0075			
Tacoma, Wash. ...	402	"	"	Mun.	but	buys	current	45900.00
Lancaster, Pa. ...	322	"	"	93.50	.0127			
Dallas, Texas	603	"	"	75.00	.0094			
Winnipeg, Man. ..	364	"	"		.0074		59.68	
Birmingham, Ala.	266	"	"	75.00	.0094			
Little Rock, Ark. .	306	3000	"		.0061		36.54	
St. Johns, N. B....	190	4000	"	75.00	.0094			
Wheeling, W. Va. .	510	"	"		.0066		52.86	
Topeka, Kan.	342	3000	"		.0071		42.47	
Terra Haute, Ind.	401	4000	"	70.00	.0077			
Salem, Mass.	314	"	"	95.00	.0119	2.62		
Elmira, N. Y.....	450	"	"	80.00	.0100			
Springfield, Ill. ...	566	"	"		.0065		52.36	
Taunton, Mass. ..	247	4000	1200		.0023		10.90	12693.00
Atlantic City, N. J	400	"	2000	75.00	.0094			
Canton, O.	274	"	"	64.00	.0080			
Jacksonville, Fla. .	372	"	"					74006.00
Galveston, Texas .	198							
Joplin, Mo.	156	"	"					
Woonsocket, R. I..	159	"	"	146.00	.0182			
Williamsport, Pa. .	221	"	"	74.50	.0093			
Kalamazoo, Mich.	296	"	"		.0057		45.43	
Bay City, Mich. ..	278	"	"		.0064		51.55	
Gloucester, Mass. .	85	3000	1200	85.00	.0236			
Hamilton, O.	312	"	"					513.00
Lewiston, Me.	150	3000	"	75.00	.0208			
Jamestown, N. Y..	350	4000	1200		.0055		19.42	16796.82
Watertown, N. Y..	199	"	2000	75.00	.0094			
Asheville, N. C. ..	97	"	"	65.00	.0081			
Lansing, Mich. ...	150	"	"					9744.34
Norwich, Conn. ...	198	"	1200					9103.00
Berkeley, Cal. ...	141	"	2000	72.00	.0090			
Flint, Mich.	150	2000	"	61.50	.0154			
Massillon, O.	181	3000	"	69.50	.0116			
Milford, Mass.	58	"	"	86.57	.0144			
Harrison, N. J....	92	4000	"	85.00	.0106			
Middletown, Conn.	105	3000	"	92.00	.0153			
Washington, Pa. ..	184	4000	"	70.00	.0087			
Bordentown, N. J.	28	"	"	90.00	.0112			
Great Barrington	232	"	32	19.50	.1445			
Marshall, Mich. ...	120	"	2000					6259.20
Hillsdale, Mich. ..	65	2000	"					1799.21
Mechanicsburg, Pa.	48	4000	"	55.92	.0070			
St. Ignace, Mich. ..	35	3000	"				5.09	1178.26
Carey, O.	In two	years	rebuilt	plant	and	has	1800.00	on hand
Blissfield, Mich. ..	36	1800	1200					213.85

For the purpose of comparison, the following table gives the prices paid in 1897 and 1902 respectively:

	1907.	1902.
Philadelphia	$109.00	$108.40
Boston	127.75	125.93
Cleveland	94.80	.....
New Orleans, La.	127.50	118.50
Jersey City, N. J.	99.00	99.00
Indianapolis, Ind.	85.00	81.75
Rochester, N. Y.	91.25	91.25
Toledo, O.	90.00	83.00
Worcester, Mass.	120.45	.....
New Haven, Conn.	98.55	91.25
Omaha, Neb.	114.50	114.50
Scranton, Pa.	91.25	.....
Atlanta, Ga.	85.00	82.50
Dayton, O.	100.00	68.50
Hartford, Conn.	79.20	.....
Reading, Pa.	105.00	.....
Wilmington, Del.	110.00	100.00
Bridgeport, Conn.	102.00	91.25
Savannah, Ga.	90.00	72.00
Duluth, Minn.	109.50	55.00
Charleston, S. C.	100.00	100.00
Schenectady, N. Y.	116.80	92.71
Ft. Wayne, Ind.	120.00	100.00
Lancaster, Pa.	70.00	70.00
Birmingham, Ala.	108.00	.....
Salem, Mass.	140.00	100.00
Taunton, Mass.	124.00	.....
Watertown, N. Y.	82.12	73.00
Gloucester, Mass.	75.00	.....
Lansing, Mich.	.....	75.00
St. Louis	74.95	.....
Baltimore	127.75	99.92
Buffalo, N. Y.	100.00	100.00
Newark, N. J.	98.55	98.55
Louisville, Ky.	84.00	74.00
Kansas City, Mo.	110.00	82.50
Denver, Col.	100.00	90.00
Columbus, O.	74.50	74.50
Los Angeles, Cal.	117.00	88.20
Fall River, Mass.	155.12	127.75
Paterson, N. J.	130.00	.....
Cambridge, Mass.	.....	100.00
Albany, N. Y.	124.00	.....
Seattle, Wash.	108.00	84.00
Richmond, Va.	58.40	58.40
Nashville, Tenn.	91.25	85.00
Camden, N. J.	138.00	120.45
Trenton, N. J.	98.50	92.50
Peoria, Ill.	98.00	59.00
Erie, Pa.	91.25	.....
Harrisburg, Pa.	85.00	82.50
Holyoke, Mass.	100.00	100.00
Tacoma, Wash.	132.00	.....
Dallas, Texas	100.00	83.75
Terre Haute, Ind.	63.95	75.00
Elmira, N. Y.	102.20	80.20
Canton, O.	87.50	82.50
Atlantic City, N. J.	127.75	105.85
Williamsport, Pa.	80.00	74.50
Asheville, N. C.	96.00	72.50

GARBAGE AND WASTE DISPOSAL

Dye Waste Disposal—Refuse Disposal in Pittsburg—Garbage Eating Hogs for Boston—New York Garbage and New Jersey—Sewage Disposal for Paterson—Garbage Disposal by Reduction.

Disposal of Dye and Wool Finishing Waste.*

BY HERMAN STABLER, ASST. ENGR. U. S. GEOLOGICAL SURVEY.

In connection with proposed plans for sewage purification, the writer, detailed by the United States Geological Survey for work under the existing co-operative contract with the Ohio state board of health, was directed to make a study of the effluent of the establishment of the Cleveland Worsted Mills Co., located at Ravenna, Ohio. The desirability of this investigation was due to the fact that the waste waters from the above named establishment, would, at the installation of sewage works, constitute a major part of the flow, the estimates indicating that even were the town fully sewered, the domestic sewage would be in quantity only twice the flow from the factory.

The nature of the investigation was limited by the fact that the town authorities had assumed all responsibility for the disposal of the said factory waste. On this account, disposal without reference to the recovery of possible by-products constituted the problem to be solved, and the solution rested chiefly in deciding whether it would be more desirable to treat the waste alone or in connection with the town sewage and what processes of purification would give the best results at a reasonable cost. Beyond a trial of screening through coke as a process preliminary to treatment with sewage, no particular line of experimentation was outlined.

The investigation was taken up in considerable detail as follows:

(a) The processes at the dyeing and finishing works and the character of the liquors resulting therefrom.

(b) The effect of such liquors upon the stream into which they are at present discharged.

(c) Methods of purification of soap and dye liquors.

*From a report to the Ohio State Board of Health.

The establishment at Ravenna, with a large discharge of dye and soap liquors, consists of the dyeing and finishing departments, only, of the Cleveland Worsted Mills Co., of Cleveland, Ohio. The material received is chiefly woven woolen cloth. The work of the Ravenna departments is to dye this cloth and finish it for sale. When received, the cloth is for the most part nearly white, but is soiled and contains size added for convenience in weaving. Before it can be successfully dyed, it must be thoroughly cleansed from dirt and size. Several "pieces" are sewed together from end to end and run over the rollers of a washing machine. The freed ends of cloth are then sewed together, making an endless belt, soft soap is poured in, and the machine started. The rollers carry the cloth round and round through the soap, whipping it up into foam. When the cloth has been thoroughly soaped in this way, water of the desired temperature is passed through in a continuous stream, washing and finally rinsing the cloth free from soap. The soapy water pouring from seven of these machines constitutes the first liquid waste from the establishment. The first discharge from each machine is, of course, very soapy. From each washing there is discharged about 5,000 gallons of water, the first 500 gallons carrying off nearly all the soap. About twenty washes are run through in the day, making a total of 15,000 gallons of very soapy water, waste A, and about 85,000 gallons of what may be called rinse water, waste B. These two wastes are not at present separated, but pass out of the wash house together with the sewage from about 40 employes into an open drain to form the first effluent. If found advisable wastes A and B could be separated for treatment without great difficulty. Waste A may be described as a heavily soaped water of a temperature of about 175 deg. Fahr., bearing with it particles of wool and cloth waste. Waste B is a warm or tepid water, nearly clear, and carrying a little soap and cloth waste. The first

effluent varies in character between waste A and waste B, according to the state of the wash in the various machines. An average sample, the composite of samples taken from the wash house drain every half hour during the working day, is dirty gray, turbid, feels soapy and lathers readily. It amounts to 100,000 gallons daily and contains in solution 350 pounds of soap, 200 pounds of "ammoniated compound," and a little sal soda, besides dirt and size from the cloth. In suspension there is more or less dirt and a considerable amount of wool fibre.

After being washed and rinsed, the cloth is passed through a bath of slightly ammoniated water known as the "crab" and is then ready for dyeing. A small continuous stream amounting to about 3,500 gallons per day flows from the crab and will be referred to as waste C.

In the cloth dyeing department are eight vats or "kettles" in which the cloth is dyed. The dyes are placed in these kettles, made up with water and live steam forced through open pipes into the liquor as a means of heating. The ually takes on color from the dye, and cloth is arranged on moving rollers and acts as a belt, passing in and out of the scalding hot dye liquor. The cloth gradwhen the required shade is obtained, the dye water is discharged and the cloth passed through a rinsing bath, dried, and turned over to the finishing department, where it is repressed and otherwise prepared for sale. The wastes from the cloth dyeing department are waste D, the scalding hot dye liquor discharged from the kettles; and waste E, the tepid rinse water and water used for washing out the kettles. Waste D amounts to about 13,000 gallons per day, being the discharge of 20 kettles each holding 650 gallons of dye liquor. It may be black, blue, brown, red, etc., but blacks, blues and reds predominate. Waste E amounts to about 65,000 gallons per day and is colored similarly to the dye liquor, but in much lighter shades.

A third department of the works discharging waste waters is the wool washing and dyeing department. In this a comparatively small amount of material (raw wool that has been cleansed of the grosser impurities) is treated. The wool is washed in wooden vats and then dyed in the same. About four vats are discharged each day, aggregating about 3,500 gallons of soapy and colored waters, waste F. Both wasn and dye waters from this department are discharged through a slatted floor into a basement which is drained. After being dyed, the wool is dried and shipped to another plant to be woven into fancy fabrics.

Wastes C, D, E and F all join together to form the second effluent from the works. This effluent varies greatly in quantity and character throughout the day, as one or another of the combining wastes is discharged in great amount. A composite sample of small portions taken every half hour during the working day has high color, an odor of mixed chemicals, and contains more or less waste cloth and raw wool fibre. It has but slight turbidity. Measurements in the wooden drain or flume showed the quantity to be about 85,000 gallons per day.

The first effluent carries about 580 pounds of chemicals as follows:

Soap	350 pounds
Ammoniated compound	200 pounds
Sal soda	30 pounds
Total	580 pounds

About 90 per cent. of this may be assumed as belonging to waste A and the remainder to waste B.

The second effluent bears over a ton of chemicals. In the dyeing processes the following amounts represent the average daily usage of chemicals:

	Pounds.
Concentrated sulphuric acid	250
Acetic acid (28 per cent.)	420
Hydrochloric acid	30
Ammonia	75
Sodium nitrate	20
Potassium bichromate	50
Sodium sulphate (Glauber's salt)	2,000
Powder dyes	1,100
Alizarin (liquid)	650
Logwood extract	300
Betanaphtol	20
Total	4,915

It will probably not be very far wrong to assume that about half of this amount is taken up by the cloth treated, the remainder, approximately 2,500 pounds per day, chiefly sulphate compounds derived from the sodium sulphate, passing out with the second effluent.

The ammonia is entirely in waste C. Waste D carries perhaps 90 per cent. of the dyestuffs and acids and a large amount of the sulphur compounds. Waste E contains smaller amounts of sulphur compounds and dyestuffs. Waste F, of course, being small in quantity carries only a comparatively small amount of these chemicals in addition to a few pounds of soap.

The first and second effluents leave the works in wooden flumes which join a few yards from the building to form the combined effluent. This is, of course, merely the composite of the two effluents. It varies in composition throughout the day from an almost clear, cold water to a warm heavily soaped liquid or a scald-

ing dye liquor. A composite of half-hourly samples taken throughout the day was a sky blue in color, very soapy in appearance, turbid from soap, and had a rather disagreeable odor of little strength.

The following table will give some idea of the nature of the various liquors:

affects the situation only inasmuch as the tendency is to take up available oxygen rapidly and retard the oxidation of organic matter. Were the effluent discharged into a small stream, the organic matter might be freed from its stability, the free oxygen of the stream might be

TABLE I.

SHOWING RESULTS OF EXAMINATION OF WASTE LIQUORS AT THE RAVENNA DYEING AND FINISHING WORKS OF THE CLEVELAND WORSTED MILLS CO.

(Parts per million.)

	First Effluent.	Second Effluent.	Combined Effluent.	Waste A.	Waste D.	Waste E.§
Color	200. Drab	Dark blue	Light blue	Drab	Black	Brown
Color*	.....	17.	.....	.....	.....	.....
Odor	Soapy	Musty	Soapy	Soapy	Musty	Musty
Putrescibility	—	—	—	—	—	—
Oxygen required	61.37	83.73	.....	.....	213.20	25.80
Organic nitrogen—Total	4.79	3.05	6.50	.....	23.70	6.23
Dissolved	2.50	.....	5.02	.....	.....	.....
Suspended	2.29	.....	1.48	.....	.....	.....
Free ammonia	Trace	5.23	.....	.....	.14(?)	2.39
Alkalinity (methyl orange or lacmoid)	172.	111.	167.	610.	.....	.....
Acidity (phonolphthalein)	Neutral	148.	198.	†328.	.....	.....
Incrusting constituents	None	65.	.....	.....	.....	.....
Solids—Total	584.	2092.	1166.	2148.	5948.	3596.
Dissolved	446.	2005.	1072.	1580.	5870.	3567.
Suspended	138.	87.	94.	568.	78.	29.
Loss on ignition—Total	217.	213.	193.	.....	.....	.....
Dissolved	130.	157.	130.	.....	.....	.....
Suspended	87.	56.	63.	.....	.....	.....
Iron—Total	0.7	3.5	.....	.....	.....	.....
Dissolved	0.3	1.2	.....	.....	.....	.....
Suspended	0.4	2.3	.....	.....	.....	.....
Sulphates‡	.....	.....	.....	.....	.....	2480.
Fatty acids	110.	.....	.....	600.	.....	.....
Temperature (F. deg., est.)	120.	160.	140.	175.	210.	110.
Number of determinations	4	4	2	1	1	1

* Standards prepared from mixture of copper and iron sulphates.
† Alkalinity.
§ Analysis shows rinse bath and not entire rinse water, which is undoubtedly much more dilute.
‡ By turbidimeter, U. S. Geological Survey field method.

None of the effluents are, strictly speaking, putrescible. While they contain considerable quantities of organic matter besides the wool waste, there seems to be a sufficient amount of preservative chemicals to prevent putrefaction in the undiluted state. After standing a long time, the effluents gradually change by sedimentation of soapy compounds and coloring matters, becoming clearer as time goes on. Disagreeable odors are not produced, and while there is no free oxygen in the effluents, the oxygen required value does not increase with incubation. It can readily be seen, however, that with dilution such as would occur by discharge into a small stream an entirely different set of conditions might ensue. The combined effluent contains as much organic nitrogen as many domestic sewages besides a considerable amount of wool waste which is subject to putrefaction. The oxygen required value is probably due chiefly to inorganic substances and rapidly consumed, and a very disagreeable putrefaction result. At present the combined effluent is carried in an open wooden flume about 300 yards to Collins' Pond outlet, a small stream whose waters flow into the old O. & P. canal (now long abandoned), thence into Breakneck creek, and thence into Cuyahoga river after a flow of some ten miles from the factory. It was, therefore, thought advisable to make some investigations along the stream.

A reconnaisance of the stream was made, samples for analysis being taken at suitable intervals. The first sample was taken just above the entrance of the waste waters from the Cleveland Worsted Mills Co. In Table 2, this sample is numbered 4,619.

It may be here mentioned that Collins' Pond is at the edge of a peat bog about one-half mile long by one-quarter mile wide, that extends to within a few yards of the buildings of the Cleveland Worst-

ed Mills Co. The water of the outlet stream has, in consequence, a high color and a vegetable or peaty odor. This must also be understood to account for the high oxygen required value and large content of organic nitrogen for a natural stream water with little or no pollution. The organic matter is not putrescible, however, and the stream is well supplied with free oxygen.

About 100 yards below the first sampling point, a good sample was taken. This was far enough below the entrance of the waste dye and soap liquors to ensure a thorough mixing with the waters of the stream. This sample was taken about 11 o'clock in the morning, when the influence of the polluting liquor—especially the dye liquors—would be a flow at the time the samples were taken. In the sample numbered 4620 in Table 2, therefore, the polluting liquors constitute approximately one-third of the flow.

The color of the stream at this point was a deep blue, and the temperature 104 deg. Fahr. The odor was partly vegetable and partly similar to that of butyric acid. It was of considerable strength, but could not be detected a few feet from the stream. On incubation the vegetable odor was eliminated and the odor of butyric acid largely increased, free oxygen and nitrates were eliminated and the high oxygen consuming power reduced by about 15 per cent. This indicates a partial satiety of the oxygen avidity of the inorganic constituents at the expense of available oxygen and some

TABLE 2.

RESULTS OF EXAMINATION OF WATER FROM COLLINS POND OUTLET AND OLD O. AND P. CANAL AT RAVENNA, OHIO.

	Above Pollution.	100 Yards Below Pollution.	Culvert ¼ Mile Below Pollution.	O. and P. Canal at Mill Street.	O. and P. Canal at Sandy Lake Road.
Sample number	4619.	4620.	4618.	.....	.....
Color	High	Dark blue	Dirty brown	.....	.....
Odor	Peaty	Dye	Soapy	.....	.....
Putrescibility	—	+	+	.....	.....
Oxygen required	21.86	61.6	32.10	.....	.....
Dissolved oxygen	5.9	3.0	2.0	3.6	4.6
Organic nitrogen	1.31	5.03	4.15	.....	.....
Free ammonia	.11	5.36	.56	.....	.....
Nitrites	None	Trace	.010	.....	.....
Nitrates	None	2.0	None	.....	.....
Alkalinity	.....	.....	99.	.....	.....
Sulphates*	88.	313.	30.	.....	.....
Solids—Total	337.	1196.	362.	.....	.....
Dissolved	305.	1060.	267.	.....	.....
Suspended	32.	136.	95.	.....	.....
Estimated flow (second feet)	1.2	1.5	1.5	2.5	3.0

* By turbidimeter, U. S. Geological Survey field method.

maximum. In this connection it should be stated that the greatest amount of dye water is discharged between 9 a. m. and 11 a. m., and between 2 p. m. and 4 p. m., although there is more or less flow at other hours during the working day. The soap liquor is discharged at irregular intervals, mostly between 9 a.m. and 3:30 p. m. Thus it happens that the worst conditions along the stream occur at about 11 a. m. and 4 p. m. The conditions at 4 p. m. are somewhat the worse because of the more extended previous flow. The samples taken along the stream were taken between 10:30 a. m. and 12:30 p. m., and therefore caught the heavy morning flow of polluting liquors. The stream now above the entrance of the liquors was about one second foot or about twice the polluting putrescibility. Compared with the sample taken above the entrance of polluting liquors we find an increase of 50 per cent. on the oxygen required determination and a decrease of 50 per cent. in dissolved oxygen; the appearance of nitrites and nitrates; an increase of 28 per cent. in organic nitrogen and 4770 per cent. in free ammonia; an increase of 256 per cent. in sulphates; and an increase of 255 per cent. in total, 248 per cent. in dissolved, and 325 per cent. in suspended solids. These are all changes such as would be inferred from a knowledge of the polluting liquors. It is of interest to note that the ratio of solids to sulphates is practically the same in samples 4619 and 4620.

A third sample (No. 4618, Table 2) was collected at a road crossing about

half a mile below the entrance of the polluting liquors. The color of the stream here was a dirty brown, the deep blue coloring matter seemingly having been precipitated before reaching this point. A disagreeable odor as of soapsuds was noticeable a few feet from the stream, and its general appearance was very uninviting. On incubation there is no increase of oxygen required, but the free oxygen is eliminated and a fairly strong odor of hydrogen sulphide is produced. The stream water is at this point putrescible.

Comparison with sample number 4620 shows that in a half-mile flow the stream largely purifies itself. There is a decrease of 48 per cent. in oxygen required and 33 per cent. in dissolved oxygen; nitrites increase somewhat but nitrates are eliminated; organic nitrogen suffers a decrease of 17 per cent. and free ammonia a decrease of 90 per cent.; sulphates decrease 90 per cent.; total solids 70 per cent.; dissolved solids 75 per cent., and suspended solids 30 per cent. Dilution by additional drainage water will account for but a trifling portion of these changes. Most remarkable is the dimunition of sulphates from 313 to 30 parts per million, less by 58 parts per million than the unpolluted stream water. Sulphates are generally quite persistent in small quantities in streams, and sodium sulphate, the chief chemical used in the dyeing processes giving rise to the polluting liquors, is very highly soluble. With the knowledge at hand we can only state that reactions take place between the polluting liquors and the stream waters that result in the elimination of nearly all the sulphates and a large per cent. of other solid matters in both within the first half mile of flow after mixing. In fact, the entire amount of solid matter in solution one-half mile below the entrance of the polluting liquors is less than in the stream above, and the matter in suspension is but little more. The organic matter is more persistent, however, for at the last sampling point we find organic nitrogen greater by 217 per cent., and free ammonia by 409 per cent., and oxygen required by 52 per cent. than above the entrance of the wastes. Alkalinities were not determined on all the samples, but the value 99 for the last sample is low—probably about half the alkalinity of the stream above. Judging from the general character of the analyses, the worst point in the stream is between samples 4618 and 4620, but can not be far from the point where 4618 was taken.

The condition of this stream has been the subject of some altercation. Two farms lie between the point of pollution and the junction with the old O. & P. canal bed. The stream is used on both for watering stock but not otherwise. The owner of one farm, on threatening suit, was paid by the Worsted Mills Co. a cash sum for alleged damages sustained. This was the beginning of a series of threatened suits by farmers, along the old canal bed, but action has not as yet been taken upon them. The Ravenna council has agreed to shoulder the company's responsibility in such suits, and expresses its intention to fight them in the courts. Among those making most bitter opposition to the discharge of the company's waste waters into the stream is the owner of the land lying along the stream from the point of taking sample number 4618 to the old canal. At the time of taking the samples, the writer questioned him at length regarding the alleged nuisance. He stated that the conditions are worst from 4 to 5 o'clock in the afternoon, that in very hot weather a disagreeable stench arises from the stream, that his stock drink the water freely without damage to their health, and that he fears deterioration in value of milk products from use of the water by his cows. He laid great stress upon this last point, but would not state that any inferior or disagreeable quality of milk or butter, due to use of the stream water, had ever been detected. In view of the character of the samples analyzed and the import of the foregoing conversation the writer was forced to the conclusion that little or no real damage could result from the condition of the stream on this farm or those below it.

Inspection of the stream was made to its entrance into the old canal bed and of the canal to Sandy Lake road, about two miles below the works of the Cleveland Worsted Mills Co. The old canal is paralleled by a discarded B. & O. railroad track. The canal bed has been largely filled up and has not been in use for many years. It serves as a sort of drainage channel for the adjacent fields and a small stream threads its way through a luxuriant growth of bushes, rushes, swamp lilies, etc., that abound on banks and bed of the old channel.

Dissolved oxygen was determined in the field at the Mill street and Sandy Lake road crossings. The results of these determinations and the estimated flow are recorded in Table 2. Little evidence of pollution could be detected at Mill street and none at all at the Sandy Lake road, at which point the stream had practically purified itself.

Experiments were made on the purification of the first, second and combined effluents by precipitation with milk of

lime, copperas and a combination of the two, with alum, with pickling liquor from iron industries, and by straining through coke, and the details of the experiments and of the cost of the treatment are given in the report.

These experiments in laboratory and field fail to show a thoroughly satisfactory and economic method for treating waste dye water. Further experimentation could not be carried on at the time, but points were noted which indicate the trend of future work for the economic solution of problems similar to that encountered at Ravenna. Among these may be mentioned the effect of sedimentation upon the liquor. In the storage tank, it was observed that a large amount of material was precipitated upon standing. All the shreds of cloth or pieces of wool fibre and a considerable amount of coloring matter went to the bottom, forming a semi-liquid sludge of very disagreeable odor. This indicates that sedimentation previous to discharge into sewers would remove some of the most objectionable features. A second and very notable point is the very rapid purification of the dye liquors in the small stream. In sewers such liquor seems to undergo little change. It will travel for miles diluted with sewage, pass through septic tanks, and through some filtering arrangements without loss of color. In Collins' Pond outlet, diluted with twice its volume of water, the first half mile of flow practically eliminates the color and causes deposition of a large per cent. of the solid matters. The chief difference seems to be in the fact that sewage is devoid of oxygen, or nearly so, while the stream waters are well supplied with it. It is the writer's opinion that some system of oxidation with sedimentation will provide the cheapest method of purification. An oxidation-filtration method may be equally good or better, but the great deposition of sulphates would seem to make the former preferable. It is hoped that experimentation along these lines may be taken up in the near future.

A simple method of recovering soap from soapy waters is described in Koller's Utilization of Waste Products (1902, pp. 210-212). Precipitation with lime, decomposition with hydrochloric or sulphuric acids, and extraction of fats with carbon bisulphide is the plan proposed. Although recovery only and not purification is intended, considerable purification is actually accomplished. This method, or precipitation with lime and copperas as before described followed by the other steps of this process, could be used at Ravenna. The profit would be but a trifle and the plan is manifestly one that should be carried out by the mill producing the waste waters. At Ravenna the burden of caring for the wastes has been taken up by the town and such a method would not be likely to meet with success when placed in the hands of municipal politicians.

Experiments with methods fairly successful under conditions approximating those at Ravenna are suggested in some detail in the report.

Reviewing the whole situation at Ravenna, it appears that chemical precipitation of the entire wastes (costing $2,175 per annum for precipitants) or of the concentrated liquors (costing $1,200 per annum) will be too expensive. Furthermore such a method, subjected to the usual slack maintenance to be expected from a small town, would not be likely to give desirable results.

Recovery schemes (such as are known giving but little profit and only economical when conducted by the mill producing the wastes) are practically barred by the fact that the disposal is undertaken by the town.

Preliminary straining through breeze coke for part or all of the wastes is very expensive.

Sand filtration as exploited by the Massachusetts state board of health, although efficient, would require 1.7 acres of 5 foot sand beds. Unless a suitable local supply of sand should be encountered, this would also be very expensive.

Based on the foregoing considerations and the success of English factories with somewhat similar liquors, in the absence of more extensive experimentation, the best arrangement at Ravenna to preserve as far as possible the purity of stream waters at a reasonable cost would seem to be as follows:

1. Provide for preliminary treatment of combined effluent of the dyeing and finishing works as follows:

(a) By screening to remove wool fibre, etc., screens of about one-half inch mesh being used.

(b) By sedimentation (or possibly chemical precipitation). For this purpose a tank should be built in two compartments so that the soap and dye liquors may be treated separately if desired. Mere sedimentation and equalization of flow would probably be the only use of this tank, but in case a higher purification were found necessary, it could be utilized as a chemical precipitation tank and should be constructed with this object in view. Proper construction for the admission of coagulants to the liquor should be provided, preferably at the factory. Suitable design for removing and drying sludge, should, of course, be included.

2. Provide for combined treatment of sewage and factory waste as follows:

(a) By septic treatment. For this purpose, a tank should be so designed that a constant flow outlet will not make a variation of more than one-third the maximum depth of the tank liquor; the minimum depth of tank liquor to be six feet. This will provide a long septic period, a fairly constant discharge, and a not unreasonable variation in surface level. design should also include sludge removal and treatment.

(b) By filtration. For this, sprinkling filters would seem to be most desirable though sand filters would be efficient.

(c) By sedimentation of filter effluent. A tank having a capacity of a few hours' flow, to retain suspended matter from sprinkling filters, would be suitable for this purpose.

3. Provide all possible gravity aeration in the flow of the factory effluent before reaching the purification works and of factory effluent and sewage in passing through the works.

4. Provide for operation under the supervision of designing engineer and state board of health to determine the most satisfactory methods of purification by the plant constructed.

The arrangement suggested, with suitable piping, will constitute a very elastic system capable of accomplishing:

(a) Treatment of the factory waste by sedimentation or by chemical precipitation and thorough aeration of the effluent.

(b) Treatment of the domestic sewage by septic tank, sprinkling filters and sedimentation.

(c) Mixture of the two sewages at any desired point in the proposed works, thus giving the factory effluent a final treatment in connection with domestic sewage.

Objection may be made to the use of sprinkling filters in the latitude of Ravenna. Upon this point, the recent experiments at Columbus, Ohio, have shown that such filters could be used with success in a severe winter at that city. Ravenna is not more than 100 miles further north and is subject to the same general climatic conditions. Furthermore, the dyeing and finishing waste will reach the septic tank at a temperature upwards of 100 deg. Fahr. The mixed sewages will, therefore, be of unusually high temperature so that no difficulty from freezing will be encountered.

Garbage and Refuse Disposal in Pittsburg.

A crusade for the betterment of sanitary conditions and the prevention of the spread of typhoid fever has been commenced in Pittsburg, Pa., by James F. Edwards, superintendent of the board of health. In a communication to Samuel Dixon, state health commissioner, he recommends the erection of a sewage disposal plant along Nine Mile Run, and that the sewage from all parts of the Thirty-seventh, Twenty-first and Twenty-second wards, along with that of Wilkinsburg and Swissvale, be turned into this plant, and that it be made compulsory for the municipalities concerned to take this step. Dr. Edwards contends that if this plant is erected the number of typhoid fever cases from that section, and among the mill men along the Monongahela, will materially decrease, the pollution of the river being at a minimum.

Dr. Edwards also favors the collection of the city's garbage by municipal employes, and its disposal by a private firm or individual. Regarding this, he says:

To my mind, the best procedure for Pittsburg is to adopt municipal garbage collection and make a contract with some firm or individual for its disposal. The collection and disposal of all dry refuse should be done by city employes, under competent supervision, and this kind of waste should be disposed of by incineration, the city building incineration plants for the purpose. In connection with these plants the heat arising from the incineration of the refuse could be used in developing power for lighting or any other purpose the city might think advisable.

To properly carry out the plan would require three or four plants in order to prevent long hauls, for hauling is the largest item in refuse and garbage disposal.

He cites the fact that the Detroit Utilization Company has offered to collect and dispose of all the refuse of Detroit free to the city if it is given the right to do so. He also showed that the city of Pittsburg is paying $155,000 for the disposal of its garbage; Cincinnati, $84,000; Buffalo, $63,000; Cleveland, $70,000 yearly, and that better results are obtained in these places than in Pittsburg. According to the official figures of the health bureau, it costs 42 cents per capita for Pittsburg to dispose of its garbage, while some other cities are doing it for 25 cents.

Hogs Proposed as Garbage Disposal Plant For Boston.

The establishment of a municipal pig sty is proposed by Mayor Fitzgerald, of Boston, who believes that the city could make $100,000 a year on a well-managed piggery. He would have the pigs fed on municipal garbage, raised by municipal prisoners and when killed, what meat is left after feeding the municipal charges, could be devoted to that famous municipal dish, Boston baked beans.

New York Garbage on New Jersey Beaches.

The mayors and other representatives of New Jersey seaside resorts made complaint to Governor Stokes recently relative to the practice of garbage collectors in Greater New York, throwing garbage and other refuse into New York Bay, whence it was subsequently washed upon the beach along the coast. Governor Stokes headed a delegation of State, city and public improvement organization officials that called upon Acting Mayor McGowan, of New York city, to protest against odoriferous and unsightly garbage that is daily strewn along the New Jersey coast. The Governor's protest contained no specific complaint, but was simply a request to the head of the city government of New York to aid in preventing a serious annoyance and menace to a neighboring State and its citizens. In his answer, Acting Mayor McGowan stated that the stakeboat is now fifteen miles out, but he would order Captain Gibson, head of the street cleaning department, in the absence of Commissioner Woodbury, to send the scows out twenty-five miles, and if necessary he would have the stakeboat sent out fifty miles or more.

Report on Sewage Disposal for Paterson, N. J.

In his report to the Board of Aldermen of Paterson, N. J., Allen Hazen, of New York city, who was engaged to investigate the question of sewage disposal, recommends a trunk sewer to tidewater as the best possible means for solving the problem. In recommending the trunk sewer, Mr. Hazen's only reservation is the contingency of a necessity to purify all the sewage below Newark. If the sewage need not be purified before its discharge into Newark Bay or New York Bay, he asserts, it is clearly Paterson's duty to join in the trunk sewer project. If the sewage must be purified below Newark it would be cheaper for Paterson to purify its own sewage. He states that the local purification of the sewage is more difficult and expensive because of the large amount of waste from the dyehouses and other manufacturing establishments, and the collection and purification of this waste when mixed with the city sewage has been investigated at length. The presence of this waste, it is estimated, will add 50 per cent. to the cost of treating the sewage. Extensive investigation has also been made of the best means of purifying the sewage of Paterson. Visits have been made to the sewage purification plants in Great Britain and elsewhere. Experimental investigations recently carried out in this country have been considered and an outline plan of a plant suitable for the treatment of the Paterson sewage has been made. A site suitable for this plant has also been found and surveyed.

The trunk sewer project has been investigated at length, principally along the lines recommended by the Passaic Valley District Sewerage Commission, but modifications have been considered. The conclusions reached are, briefly, that from a physical standpoint there is no good reason why the sewage of the Passaic Valley should not be discharged into tide water, either in New York Bay as proposed, or in Newark Bay near the end of Kill van Kull.

Either the trunk sewer or local purification would completely serve the desired end of preventing the pollution of the Passaic River by Paterson, although in either case it is essential that the dye establishments and other manufacturing establishments be required to connect with the sewers. The Passaic River cannot be adequately purified without doing this. The cost of the necessary works will be very great, whichever plan is adopted, and special legislative assistance will be required to allow the financial arrangements to be made.

Garbage Disposal by Reduction Methods.*

BY ROBERT YARNALL, PHILADELPHIA, PA.

The average American city's waste, not including sewage, is divided into the following component parts: Light refuse (including street sweepings), 10 per cent.; ashes, 73 per cent.; garbage, 17 per cent.

By refuse is meant all miscellaneous waste collected from the markets and households, such as paper, boxes, bits of wood, and miscellaneous rubbish, a large percentage of which is combustible.

The 73 per cent. of ashes collected from households, factories, and institutions, in the average American city, contains a very small percentage of unconsumed carbon, a very much smaller percentage than found in foreign practice. The proper use for these ashes is for filling purposes, and under certain conditions they can be used for making concrete.

In this discussion, by garbage is meant animal and vegetable waste matter subject to rapid decay, collected from kitchens, markets, slaughter-houses, etc.

*From a paper before the Franklin Institute, printed in the *Journal of the Franklin Institute.*

These percentages vary greatly with the geographical location of the community, with the season of the year, and with the particular kind of season; that is, whether rainy or dry, hot or cold. In fact, every change in the natural order of living affects to a greater or less extent the above values and their relation to one another. For instance, the percentage of ashes in our Southern cities is very much lower than in our Northern cities; in our Northern cities it is a great deal higher in winter than in summer, while in the South it is a fairly constant quantity throughout the year.

Then the percentage of garbage will increase materially in the summer because of the large increase in vegetable matter contained therein. In our Southern cities the percentage of grease in the garbage is very low because of the small proportionats consumption of meats.

The kind of season influences particularly the quantity of garbage; it also influences somewhat the quality of the garbage. If for any reason the weather conditions have interfered with the growing of melons, sweet corn and fruit, the amount of garbage in July, August and obnoxious fumes emitted from the fur-September will decrease surprisingly. On the other hand, if the season has been favorable the vegetable matter assumes prodigious proportions in these months.

It is interesting to note the difference in the quality of the garbage in our Eastern cities, its physical as well as chemical changes.

The material collected in Baltimore is very inferior, indeed. It contains but a small percentage of grease and a very large percentage of rubbish and objectionable matter. Baltimoreans seem to live largely on fish foods—oysters, crabs, etc. At certain seasons the crab shells assume surprisingly large proportions; in fact, often at a distance a load of garbage has a decided pink color due to the crab shells.

Philadelphia garbage is in a very much better mechanical state than that of Baltimore, but the percentage of grease is much lower than in some of the other cities, such as Newark, N. J., New York and Brooklyn, although much higher than in Baltimore. The reason for this comparatively low percentage of grease in Philadelphia is to be found in the non-enforcement of an ordinance barring private collectors of garbage. A recent Supreme Court decision has sustained such an ordinance. These "hog feeders" go from house to house in the best sections of town and to most hotels and boarding houses and collect only the best of the material for feeding their swine, and leave for the regular collectors the poorer materials, from which material only a small percentage of grease, as above ctated, can be extracted. This practice should be stopped at once, not only because of the poor quality of pork produced by swill-fed hogs, but because by so doing the city will be able to obtain lower bids on the scavenger contracts if the material is to be reduced.

The garbage collected in New York city is the cleanest—containing the least amount of refuse—in any city in the East. The reason for this condition is found in the rigid enforcement of the law governing separation of the three kinds of waste. The fact that the material is richer—that is, contains more grease, ammonia, potash, etc., per ton—in New York city than any other Eastern city, with the possible exception of Atlantic City, is because of the barring absolutely of all private collectors, and also because of the great number of hotels and apartment houses from which the waste of foodstuffs per capita is much greater than from private households, or from a less thickly populated community where there is an opportunity to scatter the material, feed domestic animals, etc.

It is interesting to note that the garbage collected in New York city is comparatively dry and can be stacked on scows like hay.

The garbage from Boston is very wet and sloppy (pardon the expression). The scows which transport the material away from the city to the reduction plant have to be provided with high sides to keep the material from running into the bay. It is difficult to explain the reason for this condition, but it must be because of some method of doing the work about Boston kitchens which differs from that employed elsewhere; perhaps the dishwater is added to the garbage. It certainly can not be attributed to the staple food of the Hub, for beans are anything but sloppy. The yield of grease from the Boston garbage is considerably less than the yield from New York, but is greater than the yield from Philadelphia, perhaps because of the greater consumption of fish foods, which are poorer in grease than other meat foods.

The method of collection and disposal of a city's waste is influenced by the size of the community and by local conditions. In considering this problem due regard must be given, first, to the sanitary, and, second, to the financial features. It must be determined whether the three grades of city waste—namely, refuse, ashes and garbage—shall be collected together in the same wagon and used for filling in land, or else be destroyed at an

incinerating plant, or whether the material shall be separated and each part collected in separate wagons specially designed for each grade of waste, and the materials thus collected disposed of by approved methods.

It seems manifestly wrong to pollute clean ashes with putrescible garbage, as this from a sanitary point of view only renders the whole mass unfit for filling purposes. It is necessary, in order that no offence be given to the householder, that the garbage be collected frequently, whereas it is certainly unnecessary to incur the great expense of frequent collection of ashes and rubbish which are not objectionable in the sense that garbage is objectionable.

It is the foreign practice to collect all waste matter together by the same wagons, haul it to a destruction plant, where the whole mass is discharged into a furnace and the combustible part consumed. In some cases there is sufficient heat generated from the burning refuse, plus some coal, to operate small lighting plants, with doubtful economy, however, judging from the reports of the Shoreditch disposal works, the most efficient plant of the kind in England.

It is possible for this to be done abroad in certain cases because of the fact, as above noted, that the percentage of unconsumed carbon in their ashes is very high. In England, particularly, open-grate fires are used almost universally, and the ashes resulting therefrom are very rich in coal. It has also been determined that their refuse contains a larger percentage of combustible matter than is to be found in American refuse. Moreover, the percentage of moisture in their garbage is considerably less than that found in this country, owing to the smaller amount of vegetable matter used for food—that is, green corn, melons, fruit, etc.—in which the percentage of moisture is very high, often as much as 85 per cent. There is therefore less water to be evaporated from their garbage, and a considerably greater calorific value to the remaining waste. It is thus apparent why the English destructor plants have been able to operate successfully where similar plants erected in this country for the same purpose have failed.

American practice, in our Eastern cities at least, is to separate the three parts of our municipal waste, collect the garbage frequently in wagons having water-tight steel bodies, and dispose of it either at a reduction plant or at an incinerating plant. The rubbish, or light refuse, is collected in wagons specially designed for this bulky material, and is hauled either to the incinerating plant or to dumping-grounds in low places in the city. There it is sorted over by Italian scavengers who recover rags, bottles and other marketable products. Or in some cases, where the city it not provided with an incinerating plant for burning garbage, as in New York and Boston, there have been built special plants for burning the worthless part of this light refuse, the mass having first been sorted over and the marketable products recovered as in the former case. In most of our American cities there is sufficient low ground available for filling purposes, and at short, inexpensive hauls, to last for many years to come.

Having decided that the householder must separate his waste into three parts, depositing each in its particular receptacle —the garbage in a water-tight garbage can, the ashes in the ash-barrel and the paper and miscellaneous rubbish in a box provided for the purpose—and having decided to keep the ashes clean and use them for filling, what disposition shall be made of the garbage?

Concerning the relative merits of incineration and reduction methods for the final disposal of this objectionable material much has been said and written. The problem is a very complex one, indeed. What is a merit in one case is a demerit in another. What is advantageous in one city is utterly out of place in another. But there are certain facts which largely govern a decision in all cases.

Generally speaking, in a city whose population is under the 100,000 mark, the returns from a reduction method of disposal are too small to warrant building a plant, unless the contract price paid by the city for the work is high, and the term of contract long—ten years or more. For such cities cremation is unquestionably the proper method to adopt.

Again, generally speaking, in a city whose population is over 100,000 reduction should be the method adopted if the cost alone is considered.

Referring for a moment to the sanitary advantages of the two systems, it has been demonstrated time and again that a reduction plant can be operated near a thickly populated district without creating any offence whatever. To cite a case in point, take the old plant of the American Product Company on the Schuylkill River, in this city, not over two miles from City Hall, and just across the river from the delightful suburban district of West Philadelphia. This plant has been in almost continuous operation for the past twelve years, and who ever heard of any complaint as to its being unsanitary or a menace to public health? If care is

taken in the design of a reduction plant, and intelligence used in its operation, there is absolutely no occasion for complaint.

A crematory can also be conducted in a highly sanitary manner; but against most existing plants in this country, at least, complaints have been entered based on the naces, or from the small particles of unburned garbage and dust discharged from the stacks.

Success of both systems, however, from a sanitary standpoint, rests almost entirely with the health officers of a city. If they are so inclined they can prevent either method from being objectionable. It is to be expected that the contractor will object to any measures imposed by the board of health necessitating his installing expensive vapor scrubbing or disinfecting devices. But such measures, provided they are practicable, can be enforced, and the comfort of the complaining district assured.

It is pleasing to the medical mind to consider incineration as the only sanitary method for the disposal of garbage, because by such a method the doctor is reasonably sure of destroying at once all microbic organisms, together with their common feeding-ground. To support him in his theories about incineration, or rather by reason of his opinions, there are to be found a great number of reports by engineers and others, both foreign and domestic, endorsing this method of disposal. It seems to those who are acquainted with reduction methods of disposal that the opinions of these doctors and engineers have been formed in ignorance of such methods. Their ignorance is due to the fact that there is practically no literature on the subject of garbage reduction and no reliable American data regarding the exact cost of reduction, or the value and quantity of products extracted per ton of garbage treated, except in the hands of the contractors bidding for city contracts, and they naturally do not care to disclose their knowledge.

It is a fact, however, that may be stated without fear of contradiction, that the net cost of reducing a ton of garbage is less than the cost of cremating the same quantity. This should be apparent to everyone. To burn a ton of garbage, it is first necessary to evaporate the 80 per cent. of water the garbage contains. It must be remembered that less than one-third of the remaining 20 per cent. of the original ton is combustible. Now, under the very best conditions of draft and arrangement of heating surface and design of furnace in boiler practice we are able to evaporate about ten pounds of water per pound combustible. Hence, to burn a ton of garbage coal must be added to it. To be sure, it takes coal to make steam to reduce a ton of garbage, but to pay for this coal are the products extracted. It may be said that if the garbage were not separated from the other combustible light refuse it would require practically no coal to burn the mass. But, on the other hand, if this same light combustible refuse were separated and taken to the boiler-room of the reduction plant it could be used to help generate steam for the latter process. There should be no uncertainty about these points. Given a specific case, results can be accurately predicted.

When all is considered, as far as sanitation goes, there is very little to choose between cremation and reduction of garbage. It must be remembered that the raw material, by reason of its origin, is subject is rapid decay and hence in the hot season is bound to be obnoxious; and it is from the handling of the raw material itself, from the receptacle to the wagon and from the wagon to the plant, that complaints arise rather than from the plant itself, be it a crematory or a reduction plant.

It is the object of the reduction plant to obtain every pound of garbage that can be collected from the city, because the plant's profit depends upon the amount of material treated, the fixed charges being very high. Whereas, on the other hand, there is practically no profit to be derived from the burning of the garbage. The collector for the crematory will therefore do everything in his power to collect as small a quantity as possible and not be detected by the muinicipal authorities. The only revenue to be derived from the burning of the garbage he collects is from the sale of the ash, but in most cases fertilizer manufacturers do not consider this ash of sufficient value for them to cart it away from the plant, let alone pay a price for it, because of its poor mechanical condition.

It is apparent in the case of the reduction contractor that a premium is placed upon honest and efficient collection; whereas, in the case of the burning method of disposal a premium is placed upon dishonest service on the part of the collector. Again, does it not seem manifestly wrong to burn up a material which, if intelligently treated by an approved process, maintains in a community a thriving manufacturing plant? Moreover, is it not manifestly wrong to utterly destroy this material when a valuable fertilizer base can be extracted from it by which, after properly treating it and distributing it throughout rural communities, there

may be returned to the earth a valuable plant food which in due time will bring forth an abundance of fruit—a point which will be more appreciated, perhaps, as time goes on and our soils become further exhausted.

After a most careful and exhaustive study of the whole waste problem of New York city about ten years ago, Col. George E. Waring, Commissioner of Street Cleaning, ably assisted by a corps of competent engineers, came to the conclusion that the most efficient and inexpensive method for the city of New York to adopt in the collection and final disposal of its waste products was for the city to insist, through proper legislation, that the householder separate the material into three parts, as above explained—the city to provide three separate and distinct kinds of wagons for the collection of these three kinds of waste—the ashes to be used for filling in land, the refuse to be sorted and burned, preferably by a small city burning plant or plants placed at convenient locations, and the disposal of garbage to be contracted for by private parties who should reduce the same by some approved method, the city itself to organize its own collecting force and do the work of collection.

It is interesting to note that American engineers and municipal authorities in our eastern cities have largely adopted Colonel Waring's conclusions. It is also interesting to note that the cost of the disposal of city waste is steadily decreasing as the processes of treatment are improving and competition is growing keener.

Having decided that the garbage will be disposed of by a reduction method, it remains to be determined which is the best reduction method. All of the reduction processes are for the purpose of separating the raw material into four parts, —rubbish, water, grease and tankage. An average sample of garbage, taken throughout the year, consists of rubbish 6 per cent., or 120 pounds per ton of garbage; water 71 per cent., or 1,420 pounds per ton of garbage; grease 3 per cent., or 400 pounds per ton of garbage.

The 120 pounds of rubbish is composed of a great variety of solid waste matter, such as bottles, tin cans, rag, bits of wood, shells, etc., which should have been separated and placed in the light refuse box by the householder and not mixed with the garbage; but perfect separation is well nigh impossible to obtain. The tin cans, bottles and rags are generally separated from the rubbish, as will be explained hereafter, and sold to different parties. The cans are put through a detinning and desoldering process, the tin and solder finding a ready market, and the iron remaining is melted up into sash weights. The bottles that are not broken are cleaned and sold to junk dealers to be refilled with cheap oils, ketchup, and other food products. The broken glass is also separated and is sold at so much a ton. The rags are washed, dried and sold to the manufacturers of paper. The cans, delivered, bring about five dollars per net ton; the bottles about four cents per dozen, the broken glass four dollars per ton, and the rags bring about half a cent a pound.

The net return from these marketable products is very small because of the amount of labor required to separate them and prepare them for market. The part that is not salable is generally carted away to the dumps, or at certain seasons is burned under the boilers in the plant.

The 1,420 pounds of water in the ton of garbage reduced contains a considerable quantity of glucose and suspended matter and a small percentage of ammonia, but it is of only slight commercial value and is allowed to run away into the sewer. When used at all it is evaporated to the consistency of molasses and added to the tankage just before drying, the combination making what is termed "granular tankage" as distinct from "fluffy tankage."

The sixty pounds of grease to the ton of garbage has the greatest value of any of the products of reduction. This grease is of a comparatively low grade and sells for about three cents a pound the year round, the price of the grease varying with the price of tallow, which, on the basis of garbage grease at three cents a pound, would sell at four cents a pound. It is of a dark brown color and has a slight odor of burnt coffee. This grease is used largely for making soap and candles. The greater part of the American output of garbage grease is shipped to foreign markets, mostly to Belgium and France. It doubtless returns to this country again in forms which have successfully obliterated their origin and which we would scarcely care to own.

The remaining 400 pounds in the ton of garbage is tankage. Tankage is the term used for the solid fibrous matter left after the grease and water have been separated in the reduction process. It is used, when properly prepared, as a base for fertilizers, as it contains small percentages of nitrogen, ammonia, phosphoric acid, and potash.

All the American systems of reduction are either modifications or the Arnold, or

mechanical system, or the solvent system.

The solvent system reduces the garbage by first drying it and then treating the dried material with a solvent, such as naptha or the lighter petroleum oils. This solvent takes up the grease in the process and the grease is then recovered by evaporating off the solvent. The latter is condensed and used over again in the process.

The most successful American system of garbage reduction, however, is the Arnold, which has been for a number of years in successful operation in Boston, New York, Brooklyn, Newark, Atlantic City, Philadelphia, Reading and Baltimore. It is the system which Colonel Waring endorsed after his most careful investigation of all the reduction and burning systems. It can be operated in a thoroughly sanitary manner; in fact the degree of perfection to which this feature may be carried lies almost entirely with the city authorities, as previouly stated.

As far as the cost of the system goes there is no process known which gives so fair a return to both the city and the owners of the plant. Its decided success in our large eastern cities is largely owing to its simplicity, its flexibility, its rapidity of operation, its sanitary features and the low cost for the reduction.

Following is a description of a plant: At the top, supported by roof trusses, is the raw material conveyor, of standard design, which receives its material from the scows or teams as they unload at the plant, and conveys it to the top of the digester building. On the under side of this conveyor, and usually centered over four digesters, are slides or gates to which are attached several spouts. By properly operating these gates and spouts the tanks are filled in turn.

These digesters, into which the raw material is discharged, are usually built about 6 feet in diameter by 16 feet long in the straight. They have a dished head with a 14-inch hinged charging door and a conical bottom to which is secured a 12-inch discharging gate-valve. After a tank has been properly filled and the cover sealed, steam at about 80 pounds pressure is turned into the bottom and the digesting begins. This process continues for about eight hours, more or less, depending upon the season of the year. In summer it takes longer than in winter to cook a tank. In order that the material may be thoroughly digested it is necessary that the tanks be vented. This is done by discharging steam from the top through a ½-inch pipe into a common vapor piping, together with the condenser, when to turn off a tank by the odor of this vapor. This odor is so very offensive that it can not be allowed to escape into the air and it is collected into one large main which terminates in a jet condenser. The tail pipe of this condenser discharges into a convenient sewer. The life of this vpor piping, together with the condenser, is very short because of the decided acidity of the steam. It slowly eats away everything it comes in contact with.

After the tank is thoroughly digested steam is turned off, and when the pressure within is reduced to atmospheric the 12-inch gate-valve at the bottom is quickly opened and the contents of the digester discharged into a sealed hopper-bottomed "receiving tank." This tank is generally made large enough to receive the contents of from two to four digesers, so that the digesters may be discharged and refilled rapidly.

The material in the receiving tank is now ready to be pressed in order to separate the liquids from the solids. The form of press varies in the different plants. Forms in wooden racks and burlap are built up under the spouts until about twelve have been made, when the truck is wheeled over to the press and the moisture and grease are pressed out from the solid, fibrous matter, which latter is known as tankage. When the pressing is finished the truck is wheeled away and the forms stripped, the racks and cloths to be used over again and the tankage to be disposed of as will be explained later.

The hydraulic press has supplanted in large measure the old screw press. The two operate similarly, except that in one case the pressure is applied by means of four screws and in the other by water pressure behind a piston in a (vertical) cylinder. But the most generally satisfactory press is the Edgerton roller press. In this machine the receiving tank is riveted to the sides of the press, which makes it very much better from a sanitary point of view, as all the drainage is within rather than without the press, as in other forms. In the roller press there are two continuous conveyor aprons,—the upper one, called the feed apron, and composed of steel slats 3 inches wide, ½ inch thick and 3 feet long, riveted close together to three heavy parallel drop-forged chains which are driven by sprockets at one end. As this feed apron moves the material in the tank is slowly worked to the front, where it is discharged on to the lower apron, which is composed of perforated slats 3 inches wide by 3-8 inch thick by 3 feet long, riveted to three parallel chains as in the feed apron. This perforated apron is continually passing between three pairs of heavy rolls held together by helical springs which give the desired pressure on

the material, and at the same time, if required, allow bits of stone or iron to pass through without breaking the machine.

The liquids are pressed out through the perforations in the apron slats, and flow down into a center drain under the press and thence to the catch-basins, where the grease rises to the surface and is pumped up into settling tanks to be prepared for market.

The solid matter, or tankage, is discharged from the end of the press into a conveyor which carries it either into the boiler room, where it is used for fuel, or into the drying department, where it is dried down to 10 per cent. moisture and bagged and subsequently sold to the manufacturers of fertilizers. The analysis of this tankage varies greatly in different parts of the country and at different seasons of the year. A fair analysis taken right from the press would be:

Moisture, 38 to 44 per cent.

Grease, 5 to 9 per cent.

Nitrogen, equivalent to ammonia, 1.2 to 2.2 per cent.

Phosphoric acid, equivalent to bone phosphate of lime, 4.2 to 7.2 per cent.

Potash, .2 to .3 per cent.

It is always a problem to decide what to do with the tankage at a given plant. At times when grease is selling very low and coal is high in price and there is small demand for low grade ammoniates, it pays to burn it under the boilers. Tankage, however, is decidedly inferior fuel because of its low calorific value, and also because of very troublesome clinkers that are continually forming. Tankage ash is worth $1.50 per ton delivered for the fertilizing ingredients it contains.

If there is a demand for tankage in the fertilizer market it pays to dry the material down to 10 per cent. moisture, or commercially dry, when its analysis should show:

Moisture	10.	per cent.
Ammonia	2.8	per cent.
Phosphates	8.5	per cent.
Potash	.31	per cent.

This dry tankage should sell at from $6 to $8 per net ton.

If the grease market is strong and the price of solvents within reason, under certain conditions it is advisable to extract the 6 per cent. or 9 per cent. grease which the tankage contains by percolating it with solvents, such as the lighter petroleum oils, benzine or naptha, or by the use of carbon bisulphid, or carbon tetrachlorid. The latter solvent is noninflammable, but unless diluted with a cheaper solvent its cost is prohibitive.

The best method of treatment is to first dry the tankage and then percolate it, using the same liquor over and over again, until it is sufficiently concentrated, when the system is allowed to drain into an evaporator which drives off the lighter solvent to the condenser, leaving the heavier garbage grease which is prepared for market. The solvent held by the tankage is recovered by the application of heat to the percolating tank. It is interesting to note in this connection that the tankage from which the grease has been extracted is now of greater value as a fertilizing material. The grease thus extracted, however, is not as valuable as that extracted by mechanical means.

The catch-basin liquor, after the grease has been taken off, has very small commercial value because it is so very dilute. It contains from .15 to .4 per cent. ammonia, and in some cases we have evaporated it down and added the concentrated liquor to the tankage during the drying process. This makes a granular tankage, which is in greater demand than the fluffy kind, but the price obtained is only a little better—in fact, is hardly enough to pay the cost of evaporation and maintain the evaporators. The cost for evaporator repairs is very high because of the acidity of the liquor, which attacks both shell and tubes, whether of iron, steel, copper or brass.

The New York garbage plant on Barren Island is the largest reduction plant in the world. In the summer months it disposes of 3,000 tons of raw material every day. One can scarcely realize the enormous bulk this tonnage represents without spending twenty-four hours on the island in August. The New York board of health is very vigilant in preventing obnoxious vapors arising from this plant because of its close proximity to Rockaway Beach and Coney Island. It requires the fumes to be washed thoroughly in great scrubbers before discharging them into the air.

About two years ago a disastrous explosion occurred in the Boston plant. One is never sure just what ingredients form the conglomeration with which the digesters are filled, and in this case an excessive pressure was formed in one of the tanks from an unknown cause and the explosion resulted, completely wrecking the building.

The records of the quantity of garbage treated at various reduction plants are interesting when examined together. The fluctuation in volume and character from month to month is fairly parallel—the yield highest in August and September—except in the case of Boston, where the greatest yield is in winter, due probably to the greater proportionate summer exodus of the leisure class. The antithesis

of this is observed in the plotted curve of quantity at Atlantic City, which has a great peak in the middle of August, the height of the vacation season, as would be expected from such a resort.

The character of the product varies also; but, unfortunately for the reduction plant, the value of the material expressed in terms of grease is much lower per ton when the quantity handled is the greatest.

These records show that a reduction plant should be made sufficiently large to handle the peak of the load in July, August and September, although during the remainder of the year, in most cases, two-thirds of the plant must remain inoperative. Moreover, when this great bulk of garbage is being treated the yield of grease—the principal source of revenue—is least, which is certainly an unsatisfactory condition from a manufacturers's standpoint. This explains the fact that the garbage reduction contractor can not undertake such a contract without being paid a bonus by the city.

REINFORCED CONCRETE

Cost Reduction of Reinforced Concrete Work.*

BY E. P. GOODRICH, M. AM. SOC. C. E.

Reinforced concrete is the present day engineering fad. Fads derive their popularity through an excess of zeal in the exploiting of the one or more worthy points which all fads possess. Such exploitation is never at the hands of those who really understand the true value of the principles on which the fad thrives, but by the admiring many who push the fad to the very extreme which causes its denomination as such.

Now, reinforced concrete has many points of really wonderful excellency. It is being exploited by an innumerable number of enthusiasts; enthusiasts with a patent reinforcing bar, with a special brand of cement of untold excellence, with a patented system for turning out articles of absolute perfection, with a scheme whereby the dear public may be let in at the formation of a company by which gold can be piled up without end, because all cement for the Panama Canal and the rebuilt San Francisco have been contracted for with the company in question, or at least its purchase promised that company, or perhaps some of that great business may be secured if the company's plant is built in time.

Reinforced concrete is being advertised in the monthly popular periodicals, beside automobiles and summer resorts and patented underwear. Beautiful illustrated booklets are being distributed containing photographs of concrete country houses and aqueducts, of concrete fences and stairways, of concrete cisterns and piggeries. Now, none of this is intrinsically wrong. It only shows where enthusiasm is leading. That the thing is being over done is evidenced by such facts as the following, with which the writer is acquainted, but also careful to add was not connected: One building has floors designed throughout 100 per cent. thicker and with 100 per cent. more steel than is necessary. Futhermore, 100 per cent. more concrete was used than was possibly required. In another piece of work a retaining wall of solid concrete 2 feet thick and 6 feet high was reinforced with five-sixteenth-inch rods spaced 2 feet apart. Of course, the rods will do no hurt in the wall. Happily, no danger is involved in those two structures, but many others exist which would long since have collapsed if loaded to any great percentage of what they are supposed to be able to support. One such building designed for floor loads of about 150 pounds showed signs of great distress when tested to only 75 pounds.

It must not be inferred that the writer is a cynic on this subject. On the contrary, he is an enthusiast, nd believes that underlying all this enthusiasm, and between the waste of energy and material, by the over-cautious builders and the poor design and workmanship by the opposite class, there is a sound practice which is also safe and will eventually become more or less standardized.

Engineering is much more than "bending natural agencies so as to produce structures of value to mankind," as it has been defined; it should also include doing so economically. The best engineer, architect or builder is the one who can erect a structure which fulfills the

*Extracts from a paper before the American Association of Portland Cement Manufacturers.

pre-determined requirements of strength, utility and beauty at the lowest cost. It is never well to approach the limiting conditions too closely, because the present state of the art makes it necessary to tolerate a large percentage of variation from the mean. On the other hand, to make use of an excessive factor of safety or provide more of a thing than can be utilized, or use better materials than the esthetic sense requires, is to throw away money which could better be used in other ways.

Of course, elements other than cement enter the problem to effect irregularities in tests, but it would be a great step in advance if cement could be so manufactured as to give as uniform tests as does steel. Then it would be possible for the engineer to reduce the larger factor of safety now demanded for concrete over that required for steel or reinforced concrete beams. Such a cement could actually demand a differential in price over the present qualities, and would be given it by many engineers. Another important point in which cement might be improved in its special relationship to reinforced concrete work, is its resistance to compression. The tendency for both mechanical and economic reasons now is toward the disuse of longitudinal reinforcement in concrete columns. But six, five, or even three-foot columns, such as are now necessary, are out of the question for most work and a much better grade of cement would receive an enthusiastic reception by all engineers.

With regard to the item of strength of reinforced concrete, the ideal will be realized when the designer can so proportion the several parts that all will theoretically be worked to equal efficiencies, and those the maximum safe ones; and the superintendent of construction can so erect the structures as to conform exactly to the design prepared.

It was a consideration of these several matters that led the writer to make a more or less careful analysis of the numerous points of possible discussion connected with this subject along the line of cost reduction, and they are here reviewed because all cement manufacturers are intensely interested in the proper use of the article without which this most valuable of fads would be impossible.

The cost of cement structures can be lessened with respect to the cost of the cement which it contains in two ways:

(a) By employing a cheap quality, or

(b) By using a small quantity.

A limit as to quality has been mutually agreed upon by a large majority of cement manufacturers and users by the adoption of a standard specification for cement. You are all familiar with this standard specification. As to a minimum quantity, only a competent engineer can decide, since a proper amount depends upon the characters of the other ingredients, upon the uses to which the completed structure is to be put, and upon the strength or quality required of the mixture under the governing conditions.

The cement is the binder holding together the aggregate which makes up the major portion of the concrete. This aggregate may be stone, sand or gravel in varying proportions, depending upon circumstances. The question as to the use of stone or gravel has nearly expended itself in discussion; the conclusions which seem to have been reached is that either is good, one sometimes better than the other, and that either or both can be used to advantage where the particles are of proper size and composition. The factors which determine the use of either article may be smothered by entirely independent conditions. As with sand, a gradation of sizes of particles is best, the maximum size being determined by the mixture which the conditions of the construction will allow. For large enterprises the most profitable combinations can often be determined only after considerable study.

As to the relative costs of different mixtures of the various concrete ingredients, it is evident that the poorer the mixture the less the cost per cubic yard. However, the concrete at least cost per yard may not be profitable under all circumstances.

Turning from the ingredients to the methods of handling them, three or four cardinal principles may be laid down regard to the operations to be carried on.

(1) A fundamental principle to be observed in the handling of concrete materials is to make as much use of gravity as possible. Especially in large work it is usually more economical to carry all materials to the tops of bins or other structures from which point they can move by gravity down through the mixer into the conveying devices. Every one is familiar with the high trestles, bins and other devices adopted on all large enterprises for the storage and handling of concrete materials.

(2) In general it may be said that the mixing should be done as near the point of installation of the dry concrete as possible, since it is easier and cheaper to handle the dry material than the wet mixture. In the case of one large building with structural stel frame, a small electrically-driven portable mixer was employed and moved about so that it dis-

charged directly at the point where the concrete was to be placed. Electric power and water could be conveyed with ease to all parts of the building by wire and hose, and, with the structural work in place, the dry materials could easily be hoisted and conveyed to the mixer. This arrangement is perhaps ideal, but every effort should be put forth to make as short as possible the distance which the wet concrete has to be conveyed. Of course, the quantities to be handled, the time in which the work must be completed, and the height of the structure are the factors which determine most completely how much and what mechanical appliances can be used.

(3) The great point in arranging the labor in connection with a piece of work is to have an organization which will run like a clock. Such a organiztion will have no superfluous members, and will work with no irregularities of action. A few extra men to do nothing but maintain proper runs for the wheelers, can often actually effect a considerable saving of time and money. Under most conditions operations should be carried on in circles and cycles. Workmen should never turn abruptly and return over the same path, but should always return by another road, thus completing a circuit and thereby preventing confusion and delay. By making all operations consist of simple cycles, each workman becomes expert in his duties and works most efficiently.

For hoisting, three methods are possible:

(1) Hoisting the material in the dry and unmixed state as has already been described.

(b) Hoisting the wet concrete in buckets or in barrows on platform elevators.

(c) Hoisting the concrete in masses which have been molded on the ground as is done in a small way with concrete blocks and as may be done with whole members.

The actual cost per cubic yard of hoisting concrete by each of these methods varies by only a few cents. The major savings peculiar to each are in the advantages they have in other respects. In the first instance, if the hoisting is done by means of platform elevators, they can be used for all sorts of other materials as well. In either the first or the last case (but especially in the first), where either the crude materials or the molded members are hoisted by derricks, these derricks are usually also available for hoisting other things. In the second case (and in the first with small platform elevators), the actual cost of the hoisting mechanism is less than when it consists of a derrick, unless the structure is very high and an entirely independent scaffolding has to be erected for the hoist. In the case of the hoisting and placing of the molded concrete structural members, the costs per yard for this item are higher than when the concrete is placed wet, but this is offset by other savings to be considered later. On three buildings almost identical in size the actual cost of the hoists installed and removed after completion of the work was as follows: Platform elevator, $330; bucket hoist, $465; derrick, $255.

Where several thousand yards of concrete are to be handled the cost is actually small for these tools. With regard to the other mechanical devices it is sometimes found that the interest on their cost, together with their depreciation, more than offsets the saving in cost of labor effected by them, but on the other hand they materially save time and in this way lessen the interest on investment and often earn large bonuses for quick work.

The style and design of the steel reinforcement for concrete work is in no sense as well established as to economy and efficiency of design and construction as are the preparation and mixing of the concrete elements. There are at the present time a dozen or more fairly well-known systems, so called. The first tendency in this country was toward peculiarities of structure of the reinforcing bar so as to develop the adhesion between the steel and the concrete. At the present time the subject of "adhesion" is giving place to that of "shear" and the use of stirrups is receiving special attention in theoretical discussions. But even now the whole subject is assuming a phase in which theory is being largely modified by experimental results and practical conditions, and engineers are adopting short methods and thumb rules in making up designs. To be sure, they are not the same sort of rules as those so widely employed in some empirical systems, however closely the former may approach the latter. This is true because of the tedious study of theory from which the present practice has been derived.

The writer has analyzed nearly one thousand tests of concrete, plain and reinforced, and has lately begun an analysis of a special series of over one hundred tests of beams specially designed to ascertain the relative advantages of the several bars now on the market. While the analysis is not yet completed, it seems to bear out the fact of which he spoke at the engineering congress in St. Louis as to what may be called the commercial efficiency of the several styles of patented bars. Any one can test this point for him-

self by securing in the open market the ruling prices for the different bars and then analyzing any one of the several well-known series of comparative tests (such as Prof. Talbot's now classical ones) to ascertain the relative cost per pound of supporting power of the beams tested with each kind of bar. The beams reinforced with plain round or square rods will almost invariably be found to support more load per dollar cost than any of the others. Twisted bars usually will be nearly equal or will hold a good second place.

The question as to the proper use and design of web reinforcement for reinforced concrete beams has lately given rise to considerable discussion. Mr. Harding's results contained in his paper before the Western Society of Engineers showed a reduction in the variation from the mean, from an average of 17 per cent. for sixteen beams without stirrups to an average of 4.1 per cent. for a like number of beams with more or less web reinforcement. This seems to the writer a very important consideration as the small expenditure for web reinforcement materially increases what may be called the factor of reliability, and furthermore, it may be possible some time even to reduce somewhat the present factors of safety when results can always be depended upon. Where ample web reinforcement is employed, failure is not sudden and destructive but is usually slow, giving ample time to prevent complete collapse and making it possible to carry out repairs with a great saving of time and expense.

The study lately given the subject of web reinforcement, because of the desirability of an intimate connection between stirrups and tension bars, brought into prominence several combinations of steel shapes which result in a more or less well marked skeleton truss. Here again the ones in which plain bars are employed will usually be found most economical. Several co-ordinate advantages result from the use of such built up reinforcing structures.

(a) They can be prepared in a shop by machines and skilled mechanics and are more easily handled and placed than are the discrete pieces.

(b) When placed in the work they may be depended upon to maintain their relative positions with respect to each other and with respect to the concrete, so that the chances of defective work from faulty placing of steel are largely avoided.

Such a possibility is not to be minimized, since the special advocate of one such system lately publicly acknowledged that of several tests conducted by independent engineers, failures had occurred in more than 10 per cent. of the cases because of defective reinforcement. If such failures occur in a system designed especially to guard against them, how much more likely is it that they would take place if work were vigorously tested in which no special precautions had been taken.

Two other points in which economies can be secured with regard to steel reinforcement are:

(a) In the sizes of the rods employed, and

(b) In their relative area with respect to the concrete.

Every one at all conversant with the costs of reinforced concrete work knows only too well the disproportionate amount due to centering. In very heavy foundation work this proportion may not be excessive, but in some buildings of reinforced concrete the labor cost of installing and removing the wooden false work, together with the cost of the material itself, has made up 50 per cent. of the entire expenditure.

The cost of the centering material itself is heavy, and when wood is considered, is growing heavier almost month by month. This is due to the constant and rapid increase in the prices of timber and lumber of all kinds, which has taken place during the past few months.

The first plan which comes to mind, looking toward the economizing of centering material, is to make repeated use of each piece. This can readily be accomplished where a building is largely a repetition from floor to floor or from bay to bay. But unless the structure is very large, a considerable time is lost through the necessary delays experienced while waiting for the concrete to set before the centers can be removed. This is the case, however, only where the concrete is handled in a wet state.

Consideration of these points led to the adoption for a series of one-story buildings of the method already mentioned, of casting on the ground, the columns, beams, girders and roof slabs and of erecting them as structural steel is handled. For the molds for columns cast on one side only three pieces are needed in place of four, if the column is molded vertically. This effects a saving of 25 per cent. for column centering material. Further, little or none of the costly bolting or bracing is needed when the concrete has a depth of but a few inches, as is all that is necessary if the columns are cast on the side. Another advantage found with these column forms, which is also

shared by the beam and girder forms under this method, is the fact that the side boards can be removed after 24, or at the most, 48 hours, and used again two or three times during the intervals in which they must be left in place if the work is done in the usual way. This alone effects a 50 per cent. saving of material, as only the narrow bottom pieces are needed in any great numbers. In the special buildings described a much greater saving was effected in the centering for the roof slabs in the following manner: The ground floor (which consisted of concrete) was installed as soon as the girders and beams had been erected. On this flat surface ordinary smooth paraffined building paper was spread, and the roof slabs marked out by narrow strips of wood of a width just equal to the thickness of the desired slabs. The reinforcing rods were then placed as required, and the cinder concrete spread to fill the molds. In this way the regular floor formed the major portion of the slab molds and the cost of centering material in this instance was almost nothing. (The ground floor might better have been laid before the slabs were molded, the roof slabs cast as above described and the large members set up on top of the slabs.) A further saving in this material was effected by this "dry" method of construction, through the obviating of the necessity of using the almost innumerable vertical supports which serve to uphold the centers when the whole floor or roof surface must be built up in wood so as to form molds into which the wet concrete is poured. These various savings effected in the material for centering cut its cost on the particular structure in question to less than 25 per cent. of what it would have been had the other method been employed.

In another building in which the "wet" method was used a saving of centering material was effected in the following manner: It was deemed best in this particular building to erect brick walls. It was then suggested that the brick work be built first and that proper recesses and flue-like openings be built into the walls. Thus by using much fewer boards these recesses could be transformed into molds into which the wet concrete could be poured. This concrete could be properly reinforced for the columns for the support of the building. In a similar way the beams and girders which were designed to come wholly or in part within the walls had the brick work so built as to form a part of the bottom and at least one side of the forms.

An indirect method of saving centering material is to devise methods whereby a lesser amount originally purchased can be used more times and thus reduce the relative cost. One such device was employed with marked success on several large buildings, and the floor molds for all parts except the girders were good enough for the whole of another building after having been used six or seven times in the first one. Instead of making the molds for the beams in the form of boxes open on the top and providing thin, easily damaged mold boards for the slab bottoms, the idea was reversed and slab bottoms were combined with the beam side pieces so as to make a box with its open side downward. This box was supported on cleats fastened to the lower outside edges of the girder boxes. Besides indirectly saving centering material, these boxes readily lend themselves to use as cores to effect a material saving of concrete, as has been mentioned above.

The cost of timber for centering is advancing so rapidly that the use of other materials is coming into greater prominence. The use made of the brick wall described above could as readily be adapted to walls made of concrete block, whether the latter were cast in situ or on the ground and hoisted and placed "in the dry." If the price of lumber advances much higher it will be possible to make core boxes of sheet metal instead of wood, but in all essential respects like those illustrated above. There are on the market several patented systems of molding concrete walls with wet concrete by making use of small metal molds. The great disadvantage with most of them is the small size of the molds employed, which thus increase the labor incident to the placing of only small quantities of concrete at any one point. After an investigation of these systems a slightly different idea was worked out with regard to the column molds. Column forms built in accordance with this idea were used very successfully on two large buildings. Cinder concrete shells 1½ inch in thickness were cast in proper molds. These shells were piled up and properly wedged into position and served as the molds into which was poured the concrete for the columns. High carbon steel wire spirals were used for the column reinforcement and these spirals were worked into the cinder shells so that no extra reinforcing was needed after the shells were put in place. Sheet iron, bent into drums of the proper dimensions for the columns, formed the outsides of the molds for casting the cinder shells and it was found most economical to employ for the inside cylinder molds expanded metal lath. The sheet iron for the outside mold gave the outside of the cinder cylinders

a smooth exterior surface (when the concrete was propely tamped), while the metal lath was fine enough in texture to prevent the concrete from running through its meshes more than enough to provide a perfect bond betwen the cinder shell and the concrete matrix of the completed columns. The process of preparing the shells was as follows: A collapsible drum was constructed, upon which was first wound the wire for the reinforcement. Outside of this was wrapped the lath, which was then fastened to the wire reinforcement by wire clips in the same manner in which metal lath is fastened together and to ordinary metal studding. The wire and lath cylinders were then placed inside the sheet metal molds and cinder concrete tamped between, to form the cinder shell. The metal sheets were held in proper shape and position by light wooden frames, but to the necessary shape and so bolted as to be easily removed. These forms and the metal sheets used for the outsides of the molds were removed after 24 hours and used for other molds; the platforms on which the cinder shells were cast being the only parts which it was necessary to leave untouched for longer periods. In this way the costs for the molds for the cinder shells were reduced to a minimum and, since the sheet metal could be very easily lapped to any extent, the same sheets served to make shells of all diameters, from the largest to the smallest, and were still available at the end of the job.

These cinder shells have many advantages:

(a) They form a fireproofing for the concrete columns, which are manifestly the most vulnerable parts of all concrete structures.

(b) They do away with all column centering.

(c) They carry the spinal column reinforcing in a manner very easily handled and with perfect certainty of no possibility of displacement.

(d) They are capable of erection with comparatively unskilled labor.

(e) They require forms for their manufacture, which are of the simplest, and because of the possibility of repeated use, are of the cheapest construction.

(f) Since round columns are the most efficient per square inch of effective area, they provide the strongest column with a given area.

(g) That portion of the concrete column which is not designed to carry any load is of poor quality material, thus making a column of slightly cheaper cost.

Turning now to the item of labor on the fabrication of centering, three points are potent in effecting economies:

(a) Have as much work as possible done in regular shops so that considerable use can be made of machinery. By this means, too, piece work can be employed with the resulting economies. For one building the core boxes described above were constructed in a planing mill and were delivered ready for erection. The wire and lath cylinders used in the cinder shells were similarly fabricated, and it is this same means which makes it possible to fabricate so cheaply the beam reinforcement in the somewhat complicated truss forms which are most effective.

(b) Have as much work as possible so arranged that it can be executed by comparatively unskilled labor. The boxes described above were almost entirely handled and placed at the building by common labor, thus effecting a great economy over the usual methods, by which labor conditions required the employment of high-priced skilled labor for working wood.

(c) Obviate as far as possible the use of the saw and the hammer. The first can be done by purchasing all material cut to stretch and by making it a cause of discharge to cut a piece of lumber. The hammer and nails should be replaced by bolts and a wrench.

The last item also goes far towards reducing the costs of removing the centering. Where the cinder shells were used there was no expenditure for removing column forms, and it was nearly a minimum where the "dry" method was employed. Of course, all builders use oil to coat the centers. A liberal use of this material greatly protects the wood against being damaged by the alternate wetting and drying. It also tends to give a good surface to the concrete, but best of all it largely reduces the costs of removing the centers.

Great care should be taken in the design of all centering, to make it as readily erected and removed as possible. It is believed that fully as much time can be profitably devoted in the office to the careful design of the centering for a job as to the design of the reinforcement. As to the latter, it is believed that each beam and other member should be as carefully analyzed as are complicated plate girders. Regular strain sheets should be prepared and preserved for record, and all elements carefully investigated. Another point for careful study in the office is that of reducing to a minimum the number of types of beam reinforcement to be used on a building. This item is even more important than in the

design of structural steel work, where it is made a cardinal point. Reinforcement and centering should be made interchangeable from bay to bay and from floor to floor as far as possible. Very often a design can be altered so that this can be effected with great economic advantage and with little or no loss of architectural or other feature.

Little can be said on the subject of tools. Of course, the tool which rises first before the mind is the mixer. In a recent issue of an engineering periodical eight different makes of mixers were advertised and as many more were added to the list with but a moment's thought. In a recent advertisement in another paper, one company called especial attention to the fact that it manufactured seven different varieties of that article. With most of the other devices there is the same superfluity, so that there is almost too wide a choice. In general, the old aphorism is found to prove true, "the best is the cheapest in the long run."

MUNICIPAL PROBLEMS

Public Play Grounds for Washington—Municipal Ownership in Germany—German Municipal Budget—Asphalt Competition.

Public Play Grounds for Washington.

The annual report of Col. Charles S. Bromwell, engineer in charge of public buildings and grounds in the District of Columbia, says that during the last year the public playgrounds committee was given permission to use five public reservations for playground purposes. Col. Bromwell called special attention to this subject in his annual report of 1904, and the recommendations therein made are repeated, namely:

That an appropriation of $3,000 be made for establishing, maintaining and caring for children's playgrounds on public reservations in Washington. It is also recommended that authority be given to this office to erect or permit the necessary structures thereon. During the past two years the public playgrounds committee has desired to place, at its own expense, temporary wooden structures for shelter and the use of children in their games, on some of the reservations that have been set aside as playgrounds. The committee could not, however, be permitted to do this, as the act approved August 30, 1890, prohibits the erection of temporary structures of any kind upon any reservation, except when authorized by special act of Congress.

Municipal Ownership in Germany.

Municipal ownership, which was one of the slogans in the last political campaign in New York, is by no means an experiment in Germany, where it has been on trial for several years. In most of the large towns the gas, water, markets and electrical undertakings are owned and managed by the local authorities. As regards tramways, German towns are not quite so far advanced as are towns in England, but it is the evident intention of the communal bodies generally to obtain possession of that important means of communication whenever the opportunity offers. In addition to the undertakings mentioned, all towns of any size have their own savings banks, and most of them carry on the business of pawnbrokers. A large majority, too, possess municipal theaters and concert halls. A few own quarries, and one (Gorlitz) makes bricks and tiles, owns a coal mine and manufactures artificial stone. In connection with the ownership of communal forests, several towns deal in timber for building purposes and the supply of fuel. Harbors, docks, quays and wharves are also owned by various towns.

In the opinion of many, municipal trading should not be conducted with a view to the making of profit. In Prussia this question is settled by law. Section 3 of the communal taxation law provides that "communal undertakings of the communes shall be administered on the principle that the income raised shall suffice at least to meet the whole of the expenditures arising from the communal undertaking, inclusive of interest and reduction of the invested capital. An exception is admissible so far as the undertaking serves at the same time a public need

which is not otherwise met." The latter part of the opinion refers to waterworks, markets and similar undertakings, but these concerns are, as a general rule, to be so managed that no loss shall fall on the local taxes.—New York *Tri-Weekly Tribune.*

Sharp Competition in Asphalt.

The proof that there is sharp competition between those who produce refined asphalts for paving purposes and that the prices are now about one-half what they were in the profitable days of that industry, and now often below cost, is shown by the bidding in New Orleans, La., for supplying refined asphaltum to that city for use in its municipal paving plant. That city, like many others, owns its own asphalt paving plant, where it mixes refined asphaltum with sand and limestone dust for the paving mixture.

Bids were offered from several, but not all the sources of supply of refined asphaltum. The companies which bid were The Barber Asphalt Paving Company, which deals principally in Trinidad asphalt, of about 56 per cent purity; the Globe Asphalt Company, which deals in a special California asphalt of about 98 per cent purity; the Warren Asphalt Paving Company, which offered its Acme asphalt, about 99 per cent purity, and the California Asphaltum Sales Agency, offering Maltha asphalt, about 99 per cent purity, at $18.50 per ton, delivered at New Orleans. It is interesting to note that, with a freight rate of about $10 per ton and $1 for loading and terminal charges, this means that the material offered to New Orleans is sold probably at a slight loss at about $7.50 per ton at the refinery in California. Trinidad asphalt, controlled by the Barber Company, being about 56 per cent pure, would have to be offered at about $10.40 per ton to meet the competition and low prices now prevailing. This would mean great loss, because it has been estimated by United States Consul Pierce in his report that it costs $8.00 per ton to put crude Trinidad asphalt on the vessels at Trinidad. Thus, when freight and insurance, $2.25, and duty, unloading, refining, barreling, shipping from New York or Philadelphia to the point used, are added, it is perfectly patent that Trinidad asphalt is not successfully competing or cannot compete with other asphalts now available at low prices at all points in the United States.

There are many asphalts now competing with one another, also scores of paving companies and contractors, with no possibility of uniting them upon a profitable and just basis, either to themselves or to the public. The asphalt industry is destined to break up more and more into small local industries, similar to the manufacture of Portland cement, building and paving brick, lime and other materials of construction.—*New York News Bureau.*

German Municipal Budget.

The Liberal party governs the city of Freiburg, Germany, and its mayor is a farseeing, progressive man, who is an expert in municipal matters.

The debt amounts to M.35,000,000; or, as four marks make about a dollar, we may call it $8,750,000.

Interest on debt is		$336,000
Other city expenses in 1905 were		768,250
Total expenses		$1,104,250
Total income of city.....		834,250
Deficit raised by taxes was....		$269,750
4-10 per cent. on houses.	$81,000	
4-10 per cent. on working capital	48.000	
1 2-10 per cent. on income	87,500	
About 1-10 per cent. on income from capital.	53,250	
		$269,750

The city required the services of 162 officials, high and low. The payroll amounted to $75,417. In this amount are included the following:

Mayor, $3,750 for year.
First burgomaster, $2,500 for year.
Second burgomaster, $1,750 for year.
City treasurer, $1,525 for year.
(Average salary of 162 officials, $465 a year.)

Theater all winter, and garden concerts all summer, expense, $26,500.

Seven schools (the cost of one university and two classic schools is paid by the state), 119 teachers' salary, $39,500.

Pensions of city officials, $2,400.

Intelligence office for working people, $1,425.

For the poor people, $24,500.
For the children's aid society, $1,225.
Poor babies' nurseries, $625.
Collecting ashes and refuse, $7,000.

Eighteen councilmen, something akin to aldermen, and 95 city congressmen, receive no salary whatever.

Among some of the items of (net) income in 1905 were:

$107,750 from 88 lots of houses.
$9,500 from 741 acres of land.
$63,000 from 8,033 acres of wood land.
$84,250 from waterworks.
$110,250 from gas works.
$32,500 from electric light works.
$33,250 from electric street railroad.
$15,750 from slaughter houses.
$5,000 from the "Rieselgut" (a farm to which the canal brings the solid sewage of the city, which goes on to the lands as manure. This farm is a great success. —*The Public.*

MUNICIPAL AND TECHNICAL LITERATURE

New Publications—Washington Water Supply—Census Statistics of Cities.

New Publications.

Directory of American Cement Industries, Fourth Edition, revised and enlarged. Edited by Charles Carroll Brown, M. Am. Soc. C. E., 636 pp., cloth $5. Municipal Engineering Company, Indianapolis, Ind.

The Directory of American Cement Industries is the standard publication of its class; in fact, the only one which gives with any approach to completeness the information to which it is devoted. The earlier editions of the Directory contained also the Handbook for Cement Users, but the increase in size of both departments and some differences in the demand for them caused a separation of the two in the third edition, which is continued in the present edition.

The cement trades are advancing rapidly and there are so many changes from year to year on account of the entry of new firms into the field, the change and consolidation of old firms and the dropping out of those who thought they had found an easy way to fortune, but found after experience that knowledge of and adaptability to the business are necessary, that each edition must be built up entirely new. Practically, therefore, this fourth edition is entirely a new book, made up from the latest city directories, trades lists and association memberships, dating in the latter half of 1905 and 1906 up to the date of going to press. For a large proportion of the cities direct returns were received from local sources, entirely independent of general lists, and this makes the lists and the information concerning the persons in them particularly accurate and reliable, especially for the smaller cities. The sources of the information for the larger cities were carefully selected and are believed to be equally accurate.

The credit rating feature of the Directory has been extended and now covers a very considerable part of the lists of manufacturers, dealers and contractors. All the ratings have been carefully compared with all available sources of information and they are believed to be reliable in all respects.

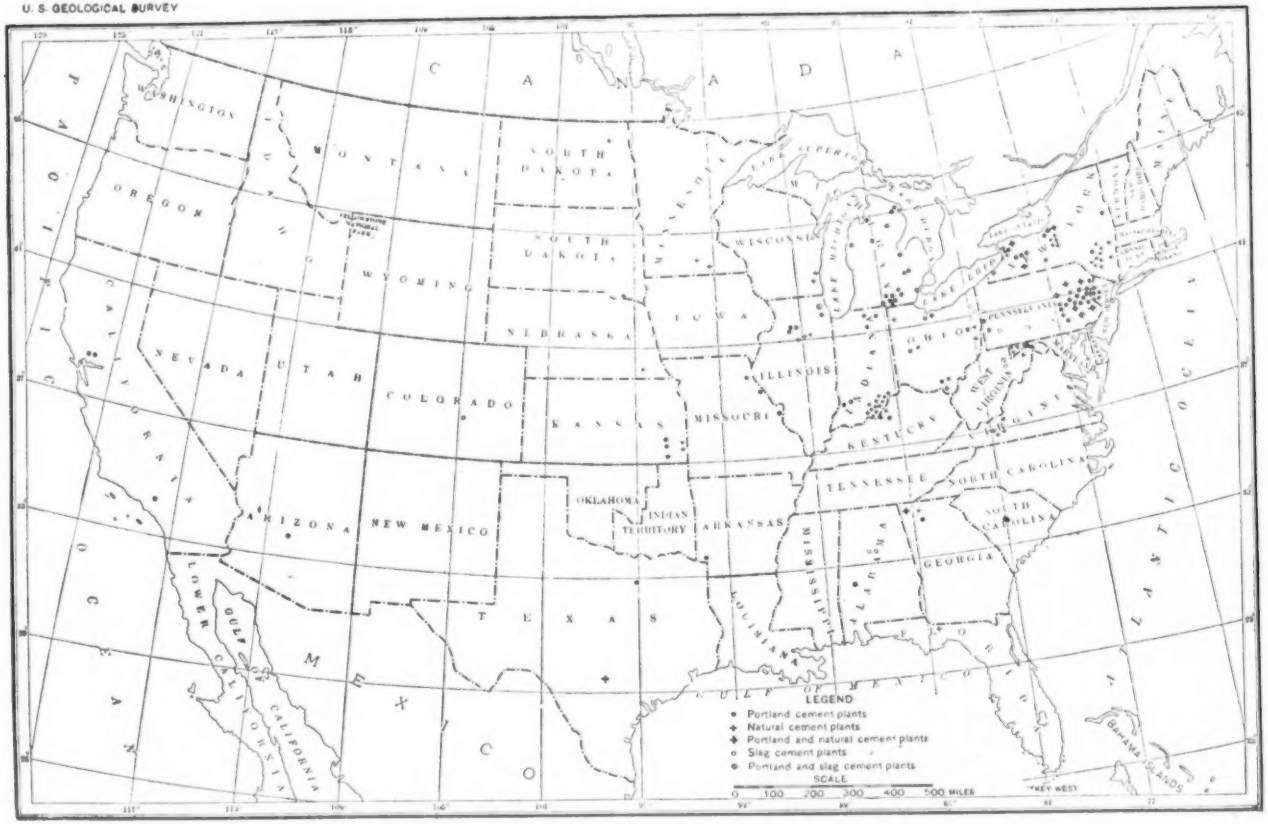
The table of freight rates on carloads of cement includes rates from the centers of cement manufacture to distributing points convenient for every State in the Union. The tendency toward uniformity of rates from mills in the same neighborhood, except for purely local deliveries, is shown in the table and the principle can be extended to include plants not named in the table. The information is all fresh and has been obtained from various sources among the railroads and cement manufacturers, and all rates have been carefully compared and corrected. The table is therefore correct within the limits stated in the foot note up to the date of going to press.

The introductory chapter gives comparative statistics of cement manufacture and the cement trade, including the full year 1905, and is worthy of close study.

The marked tendency of cement plants toward standard methods of construction has made unnecessary the more detailed descriptions of them which have appeared in previous editions and their place has been taken by a few lines in the directory of manufacturers showing the materials used and the process, the capacity and storage capacity of plants and names and kinds of brands. The consolidations of plants since the last edition are shown, the new plants and the changes in old plants. This list also gives the names of officers and directors, capitalization, sales agents and shipping facilities. It has been brought down to date in these particulars, mainly by the courtesy of the managers of cement companies in furnishing the required information.

The brands of cement manufactured are also listed alphabetically in the directory of cement brands, which gives kind of cement, name and location of manufacturer, and names and addresses of sales agents. A supplementary list gives the names of the principal brands of foreign cement found on the market, with the names of importers handling them.

The sales agents are also listed alphabetically in the directory of sales agents, for each being stated the companies they represent and the brands and kinds of cement handled.



LOCATION OF CEMENT PLANTS.

The geographical list of cement manufacturers is a convenience which has been found valuable. In this list the names of cement companies are grouped by states, the names appearing in each State in which main offices and works are located.

The list of cement company names not now in use shows those which have fallen by the wayside since the third edition was issued. Some of these were incorporated companies, some only prospects. A few are flourishing companies which have changed their names and a few are names of companies which have consolidated with or sold their plants to other companies.

The list of dealers in cement and building materials has been carefully compiled and includes the cities of more than 2,500 population with a considerable number of representatives from smaller cities and towns. The thoroughness with which credit ratings have been made for this and the following list of contractors shows its reliability. There is an increase in number of 20 per cent. over the list in the third edition, showing the expansion of the trade in extension. The increases in number of barrels handled a year, reported by many dealers, show the increase in business of those already engaged in it.

One of the most difficult problems in the preparation of the Directory is the classification of contractors. There are so many differences of opinion regarding the proper designation of a contractor that lists received from different sources are quite different in character. The man's own statement has been taken in every case where it could be obtained, and judgment regarding others has been made from from the best information obtainable. Many names in the third edition have been cut out on this account, as well as many which have dropped out of the business, thus reducing the total number of names about 10 per cent., to the benefit of the book. There may still be some errors of inclusion, but the credit ratings show the amount of business done. The additions to the list of cement contractors are made so rapidly that there are undoubtedly some errors of omission, but they are believed to be few except possibly in two or three of the larger cities where the best lists available were eight or ten months old. There is no list of cement contractors in existence of equal extent or of a reliability approaching it.

The list of makers of artificial stone, hollow cement blocks, cast stone, cement posts, sewer pipe, brick, etc., shows the greatest increase. It is nearly four times as long as the list in the third edition. While the manufacture of cement products is fully recognized in many cities and lists of those engaged in it are to be found in some city directories, this list is doubtless not complete, although every effort has been made to make it so. There have been many changes in the business during its period of development, and it has been necessary to use the pruning knife quite vigorously upon this list also. The trade is becoming more settled and within another five years should become more stable with, probably, considerable additional developments.

The list of engineers and architects is a new one of about the same length as that in the previous edition. It is particularly full in the names of city engineers, probably the most complete list of these officials in print.

The list of persons and institutions making analyses and tests of cement and cement materials and designing cement plants has been revised and again included in the Directory.

The list of manufacturers of machinery and supplies for cement plants and machinery and tools for cement users has also been revised and extended. The most notable extensions in these lists are those in cement brick machinery, concrete fireproof construction, concrete mixers, crushers, hollow concrete block machines, joist hangers, molds for artificial stone, cement and mortar colors, tools for cement workers, wall ties, waterproofing.

Those who wish to get in touch with the people engaged in any branch of the cement business or in lines connected therewith will find the book as invaluable as it is unique.

The book closes with a reproduction of a map from a U. S. Geological Survey report, showing the location of cement plants in the United States. It is given herewith as an excellent showing of the widespread extent of the industry at this time, notwithstanding the fact that a great majority of the cement is made in two or three States.

Needs of Washington's Water Supply System.

In his annual report to General Mackenzie, chief of engineers, Captain Spencer Cosby, engineer in charge of the water suply system of Washington, D. C., invites attention to the danger of an interruption of the water supply by an accident to the conduit. He points out that the fact that it has stood for nearly half a century, and without interruption in its use other than to empty it periodically for cleaning, is no guarantee that it

will not be interrupted in the future. It includes seven tunnels, aggregating 4,364 lineal feet, in seamy rock, and unlined. The tunnels cannot be lined until a new conduit is built. At every cleaning fragments of rock are found to have been dislodged from the roof. There is an appreciable risk of more or larger pieces falling in, sufficient to block the tunnel for a considerable time. He says:

There are twenty-six culverts, nearly all in made ground, the failure of any one of which would break the conduit. They are of massive construction, but equally strong ones have been washed out and these may be. The Dalecarlia (receiving) reservoir is formed by an earthen dam across a valley. In this dam is the by-conduit. If that dam should break the by-conduit would be destroyed and the supply of the District completely cut off.

The statement is justifiable that notwithstanding its fifty years of uninterrupted use the Washington aqueduct is more vulnerable than the average of similar structures and that there is risk of an accident to it which would cut off the supply for a period long enough to case a water famine, which would involve a cancellation of all fire insurance and a partial depopulation of the city, besides other and more calamitous consequences. That risk can be underwritten only by the construction of another conduit, or by increasing the supply in some other way. With the idea of insurance paramount, a new conduit should not be built alongside the present one, but should follow a radically different course, to reduce to a minimum the chance of a single cause disabling both. For that reason all possible alternative routes and sources of supply should be examined and the preliminary surveys become more important and more extensive and will require more time.

An estimate of $10,000 for the surveys and investigations is submitted and its favorable consideration is urged. The cost of these surveys and any probable cost of a second conduit will be a very cheap insurance against the interruption of the water supply, which will remain a constant menace to the District until such insurance is effected.

The report contains many tables in regard to the consumption and waste of Potomac water, showing a reduction in the average consumption this year, as compared with last. Captain Cosby says this is due to the milder weather during the winter months. During the early part of 1905 the cold was much above the normal and caused an abnormal increase in the waste of water, while the past winter was an exceptionally mild one and the increase in waste was less than any of the five preceding years. A table giving the mean daily consumption from 1874 to 1905, according to Captain Cosby, shows clearly not only that the per capita consumption is much greater than it should be, but that it is actually increasing from year to year.

In the annual report of 1905, Lieut.-Col. Smith S. Leach, corps of engineers, recommended that immediate and drastic measures be taken to reduce the waste and that the preliminary work for locating a second conduit be authorized at once. Captain Cosby earnestly repeats these recommendations. The feasibility of securing the additional supply from some other point on the Potomac, above or below Great Falls, or from an entirely different source, should be carefully investigated at the same time and the estimates of each proposed system should be submitted. He says:

The current appropriation for the District of Columbia includes an item of $100,000 for purchase and installation of water meters. This is sufficient only for about 10 per cent of the service. Unless provision is promptly made to extend greatly the installation of meters, so as to reduce effectually the excessive waste of water, it is of the utmost importance that steps be taken immediately to increase the water supply of the District. To make the necessary preliminary investigations and surveys an estimate of $10,000 is submitted. It is believed that this work should be undertaken whether or not it is decided to mater all services.

Regarding the filtration plant he says that all the important work of construction was completed at the close of the fiscal year, the work now in progress including the building of concrete steps, grading, improving the roadways and beautifying the grounds.

It has been recognized from the beginning that some method of preliminary treatment, either chemical or mechanical, would have to be applied to the raw water in order to secure a clear and satisfactory effluent at all times. Several bills providing for such treatment, were introduced in Congress during the past session, but none of them was acted on by either house. Objections have been raised by citizens in the past to the use of a coagulant, and it is hoped during the coming year to carry on a series of experiments to determine more definitely the best practical system of preliminary treatment. As to the necessity of some form of preliminary treatment, there can no longer be a doubt, if properly applied, it ought to increase the efficiency and diminish the cost of operation of the filters, besides acting as a safety valve during an extended period of high turbidity in the river water, such as occurred during the latter part of June, 1906. It is strongly recommended that authority be granted, for the time being, at least, to apply a coagulant to the raw water when necessary.

Captain Cosby submits estimates for making improvements he considers necessary at the three reservoirs.

Census Statistics of Large Cities.

The census bureau issued bulletin 50, August 7, on statistics for 1904 of cities having a population of over 30,000, the cities covered numbering 151. New York city has the largest land area, 209,218

acres; New Orleans, 125,600 acres; Chicago, 114,932 acres. Hoboken has the smallest land area, 825 acres. The total corporate expenditures of the 151 cities for the fiscal year 1904, exclusive of payments by one departmnet of the city to another, were $554,440,215, of which those of New York constituted $167,060,171, or three-tenths.

The total expenditures showed an increase of $27,108,713, or 5.8 per cent, over 1903, and of $85,040,500, or 18.1 per cent, over 1902. The increase for the single city of New York during the two years ending 1904 was $37,964,625, or 44.6 per cent of the total increase. In the 151 cities the amount spent for permanent works increased almost 6 per cent over 1903.

Of the total running expenses of the 151 cities, 61.7 per cent went for salaries and wages and 38.3 for all other objects.

Total receipts were $504,175,998, of which $472,423,858, or 79.5 per cent, were from taxes and other revenues, and $121,752,140, or 20.45 per cent, from loans increasing indebtedness.

The receipts from municipal industries, such as gas and water works and other commercial revenues, amounted to $112,266,827.

Of the municipal industries by far the most important are the water works. They are reported by 108 of the 151 cities, and their value constitutes 63.8 per cent of the aggregate value of all municipal industry properties. The cities of over 100,000 population not owning water works were San Francisco, New Orleans, Indianapolis, Denver, Omaha, New Haven, St. Joseph, Scranton and Paterson. Of the $8,000,000 invested in electric light works, Chicago reported about one-half. Nearly all of the $31,000,000 invested in gas works was reported by Philadelphia. Four cities were shown to be in the irrigation business, Denver, Los Angeles, Salt Lake City and San Antonio; three had toll bridges, New York, Covington and La Crosse, and two were operating municipal ferries, Boston and Portland, Ore. The only city running a stone quarry and crusher was Auburn, N. Y., and the only one having a municipal asphalt plant was Detroit.

The aggregate value of the properties of all municipal industries as here reported was $790,570,726. The 151 cities have already met from general revenues nearly one-half the cost of their industrial plants, but still owe 53.4 per cent of the total value. Outlays for permanent improvements are met from current revenues in American cities more generally than in British.

The aggregate debt of the 151 cities at the close of the year was $1,534,462,655, and debt less sinking funds, $1,228,216,933, more than one-fourth greater than the national debt. The per capita debt less sinking funds was $56.97. Of the individual cities, the largest per capita net debt was reported by Newton, Mass., $125.58; the second largest by New York, $113.25; the third by Boston, $108.17, and the fourth by Pawtucket, $104.19. Only ten other cities had a per capita net debt of over $75.

The tax levy per capita was largest for Boston, $30.16.

ORGANIZATIONS AND INDIVIDUALS

A. S. M. I. Convention—L. A. M. Convention—Safety Devices—Block Machine Makers—Technical Meetings—Civil Service Examinations—Personal Notes.

Birmingham Convention of American Society of Municipal Improvements.

The next convention of the American Society of Municipal Improvements will be held at Birmingham, Ala., beginning Tuesday morning, October 9. The local committee is making ample preparations for the reception of the society and the various committees are doing their full duty by the program. It is not usual to announce the details of the program in advance of the meeting, but the list of subjects for papers so far received is so excellent that it is presented as one of

the best inducements for municipal officials to attend the meeting.

James Owen, Newark, N. J., chairman of the Committee on Street Paving, reports several papers in prospect, for some of which he has not yet received information regarding titles. The following have been received:

"Paving and Paving Materials of the Southwest," by Walter F. Reichardt, Little Rock, Ark.

"Earth Settlements in City Streets," by Horace Andrews, C. E., Albany, N. Y.

"The Municipal Asphalt Plant at Hamilton, Ont.," by E. G. Barrow, City Engineer, Hamilton, Ont.

"Tests of Other Wood Than Yellow Pine for Block Pavements," by F. A. Kummer, New York City.

The papers on sewerage and sanitation are the following at this date:

"Yellow Fever and Sanitation," by J. N. Hazlehurst, C. E., Mobile, Ala., chairman of Committee on Sewerage and Sanitation.

"The Improvement of the Sanitary Condition of Gowanus Canal, Brooklyn," by Henry R. Asserson, C. E., Department of Sewers, Brooklyn, N. Y.

The serious illness of Mr. Hazlehurst will prevent his attendance at the meeting.

Mr. Julian Griggs, chairman of the Committee on Waterworks and Water Supply, has provided the following excellent papers:

"The Waterworks of Archangel, Russia," by Ulrich E. Taubenheim, manager.

"The Cost of Cleaning and Grubbing a Reservoir Site," by Julian Griggs, C. E., Columbus, Ohio, chairman of Committee on Waterworks and Water Supply.

"Recent Advances in the Purification and Softening of Public Water Supplies," illustrated with stereopticon, by Geo. W. Fuller, New York city.

"The New Orleans Waterworks," illustrated with stereopticon, by Geo. G. Earl, general superintendent Sewerage and Water Board, New Orleans, La.

Mr. T. C. Hatton, chairman of the Committee on Disposition of Garbage and Street Cleaning, is preparing a thorough report for his committee and has received the following subject for a paper:

"A Proposed System of Final Waste Disposition for the City of New York," by Howard G. Bayles, Met. Eng., New York city.

Mr. Owen has secured a paper on "The Municipal Control of Planting and Care of Shade Trees," by William Solotaroff, secretary and superintendent of the Shade Tree Commission, East Orange, N. J.

S. H. Weissleder, Cincinnati, O., the chairman of the Committee on Municipal Franchises, reports progress upon his report.

Two members of the Committee on Review, A. Prescott Folwell, C. E., chairman, Easton, Pa., and Thomas D. Allin, City Engineer, Pasadena, Cal., state that they will have full reports ready for the convention.

G. A. Parker, Hartford, Conn., chairman of the Committee on Park Development and Maintenance, reports an active canvas and papers promised, but has not yet supplied the titles of them.

The chairman of the Committee on Exhibits resigned and the work of that committee has been put in the hands of Robert K. Davis, Hammond Building, Detroit, Mich., who reports active preparation for the meeting, with prospects for a good exhibit of materials and machinery for municipal work of all sorts.

Geo. W. Tillson, Municipal Building, Brooklyn, N. Y., is the secretary, and Charles Carroll Brown, Commercial Club Building, Indianapolis, Ind., is the president of the society, and either will respond to requests for further information.

Chicago Convention of the League of American Municipalities.

The tenth annual convention, League of American Municipalities, will be held in Chicago, September 26, 27 and 28. On the program are the following papers and addresses:

Address of welcome, by Hon. Edward F. Dunne, mayor of Chicago; response and president's address, by Hon. R. C. Rhett, president of the League and mayor of Charleston, S. C.; report of Committee on Uniform Municipal Reports, by Hugo S. Grosser, city statistician, Chicago; "The Influence of Taxation on the Prosperity of Cities," by Lawson Purdy, secretary New York Tax Reform Association, New York city (Hon. George Stewart Browne, of Baltimore City Council, will lead in the discussion of this paper); "Prime Requisites of Successful Municipal Administration," by Andrew Rosewater, city engineer, Omaha; "Franchise Conditions in the City of New York," by Harry P. Nichols, chief of Bureau of Franchises, New York city; "Baltimore's Great Sewerage Problem," by Calvin W. Hendrick, chief engineer Sewerage Commission, Baltimore; "The Influence of Sanitation on Mortality," by Chas. J. Whalen, M. D., Commissioner of Health, Chicago (Dr. Quitman Kohnke, health officer, New Orleans, and Dr. Thomas M. Koon, health officer,

Grand Rapids, will lead in the discussion of this paper); "Sewage Filtration," by Alexander Potter, C. E., New York city; paper by Robert W. Speer, mayor of Denver; "Municipal Ownership," by Frank Parsons, Ph. D., chairman Boston Municipal Ownership League, Boston, Mass., and Prof. Frank H. H. Roberts, Denver University, Denver.

The last day of the session will be given over to the discussion of Municipal Ownership. Prominent officials and business men holding views for or against the proposition, will take part in this discussion, among them being Mayors Dunne, Chicago; Bookwalter, Indianapolis; Sharpe, Winnipeg; Coatsworth, Toronto; Adam, Buffalo; Weaver, Philadelphia; Brand Whitlock, Toledo. Other officials and business men having pronounced views on this subject, will be invited to participate.

John MacVicar, Des Moines, Iowa, is secretary, and will give further information on request.

An Exposition of Safety Devices.

The American Institute of Social Service will hold in New York city, in January next, an exposition of devices for safeguarding the lives and limbs of working men and women, and for preventing accidents under the ordinary condition of life and labor to which the general public is exposed.

The interest of manufacturers generally is solicited, as well as that of organizations whose special function is to improve the conditions of labor, and a widespread response is looked for to this request for representation in the nature of photographs, descriptive drawings, models, and as far as possible, the devices themselves in actual operation. Following are some of the groups of exhibits:

Section 1. Models, photographs and drawings of scaffolding, as well as the personal equipment of workers in building trades. 2. Protective devices for boilers, water gauges, signal apparatus, boiler and pipe valves; also protective devices for electrical machinery and acetylene apparatus. 3. Protective devices for motors and power transmitters, devices for turning on power and shutting it off, belt connection, couplings, etc. 4. Fire protection and the prevention of explosives. 5. First aid to the injured. 6. Mining and quarrying; devices in use on stone crushing machinery, etc; storing of explosives. 7. Metal industry; safety devices for metal-working machinery. 8. Textile industry; safety devices for looms, carding, etc. 9. Leather and paper industry; safety devices for paper cutting. stamping and moulding machinery. 10. Safety appliances for elevators and hoisting apparatus models. 11. Food products; safety appliances for kneading machines, rollers and cutters. 12. Personal equipment of workingmen; protective spectacles. respirators, suits, etc. 13. Workingmen's dwellings. 14 and 15. Housing; models, plans, photographs and plans of toilets, dressing and living rooms, baths, etc. 18. Cooking; demonstration in heating food; models, plans, photographs. 19. Other social betterment institutions; reports of labor departments, industrial arbitration courts. 20. Agricultural machinery; safety appliances on same, demonstrated by models and views. 21. Lumber industry; safety devices for band and circular saws, planing machinery, etc., demonstrated by models. 22. Models. photographs and plans of workingmen's industrial betterment institutions of all kinds.

Requests for information regarding space should be made to Dr. William H. Tolman, director, 287 Fourth ave., New York.

Concrete Block Machine Manufacturers' Association.

The second annual meeting of the Concrete Block Machine Manufacturers' Association of the United States was held in the parlors of the Wayne Hotel, Detroit, Mich., August 8th and 9th.

The meeting was called to order at 11 a. m. on Wednesday by President J. F. Angell, of Columbus, Ohio. President Angell, in his annual address, dwelt on the progress made by the Association during the past year in their various lines of effort, and also read the financial statement, showing the organization to be in a healthy condition in this regard. The report of the Secretary, Sid L. Wiltse, of Jackson, Mich., was also read. Mr. Wiltse strongly recommended that the Association change its name so as to include in its membership all manufacturers of concrete machinery.

At the afternoon session on Wednesday the convention was addressed by Mr. Richard L. Humphrey, president of the National Association of Cement Users. Mr. Humphrey spoke at some length on what the government was doing in the investigation of concrete blocks and urged the earnest co-operation of the block machine manufacturers, as well as block makers in assisting the Government Commission in the work of making the tests.

Mr. Humphrey's address was followed by a lively discussion of the question and all of the machine manufacturers present signified an earnest desire to co-operate in every way possible in making the tests. A resolution was introduced and unanimously carried, recommending the different kinds of blocks to be used in making the official tests. Mr. Humphrey stated that Congress had appropriated $100,000 for the expense of these tests during the current year. This amount, however, was not sufficient to carry the work to an effective conclusion and it was urged that all of the manufacturers use their best influence to have Congress continue to appropriate from year to year until the work was completed. The convention seemed to realize the great importance of this movement and it produced more general discussion than any other subject before the meeting.

The paper on "Concrete Block Insurance" was read by Mr. Sid L. Wiltse. Mr. Wiltse stated in his paper that while considerable progress had been made towards securing a lower rate of insurance on concrete block houses, the progress was slow. The insurance companies did not feel inclined to give concrete block a better rate than frame or brick veneer until some practical tests have demonstrated the superiority of the block as a fire resisting material. The following extracts from letters were read by Mr. Wiltse to show that the principal difficulty met with is the poor quality of the blocks made by many manufacturers and the necessity of improving the quality of blocks before any improvement in the insurance situation can be expected:

Mr. W. G. Sanderson, who has made a number of tests of blocks for the fireproofing committee of the National Fire Protection Asociation, says in his letter:

About 100 blocks were received at Chicago and about 300 were purchased at different points and shipped to Cleveland, Detroit, St. Louis and other points where facilities for testing were available. Most of the tests were made in annealing ovens in foundries, by closing the openings in ovens with blocks. A careful record of such blocks was kept showing age, proportions and methods of curing as nearly as could be determined from the meagre information supplied by the manufacturers. Temperature readings were from pyrometers of the ordinary type.

About 80 per cent. of the blocks failed under test, which was unsatisfactory. A few stood ordinary fire test, but upon investigation it was found that some such blocks were especially prepared for the test.

We are now working in conjunction with a number of technical organizations and are preparing blocks for an extensive test to be made this fall at the St. Louis Laboratory.

Further tests will be made at other points, principally Chicago, in order that our companies may be positive that the position taken by the various rating bureaus is justifiable.

Until the average manufacturer produces a block worthy of consideration, all buildings constructed of such material will be rated frame or brick veneer, depending upon occupancy and size of building. It is up to your organization to formulate a plan whereby a better and more durable block is produced and until such a result is obtained I doubt whether insurance companies will change their attitude in rating.

Mr. E. T. Cairns, of the same committee wrote as follows:

The attitude of insurance interests is still much the same as it has been for several years past, viz: we are still waiting for proof either one way or the other as to the fire resistance of concrete blocks. The few real tests to which they have been submitted have not been altogether encouraging, nor have they justified any sweeping condemnation of the material. I am still of the opinion that the thing to be emphasized from ours, as well as other viewpoints, is the necessity of intelligent honest workmanship in the production of blocks. Lack of attention to that feature has done more harm in your industry than all the other things put together, and I hope you will have occasion at this forthcoming meeting to again emphasize that fact, even though it may appear to some as an old story.

Another thing that I would feel grateful to have you mention is the desire of our committee to receive reports of all fires occurring in buildings of concrete construction of any type. We need all the information obtainable along this line, but needless to say, we want it to be correct and without bias.

In regard to Mr. W. G. Sanderson, I was not fortunate enough to see any of the tests he conducted, but have talked with him on the subject several times; in fact, he is a member of my committee, and I know he has a wide range of experience with the blocks submitted. Some turned out pretty well, some showed up so poorly that I doubt if their makers would care to hear about it.

Mr. Wiltse emphasized the point, which is the same for which MUNICIPAL ENGINEERING has been contending for four years or more, by saying in his paper:

Mr. Sanderson is certainly right when he says "its up to our organization." We must now get a move on us, or sink on the insurance question, and we cannot afford to let this matter drag, notwithstanding the fact that we are not altogether responsible for the blocks he used in this test, as our committee was supposed to be present at this test, but for some reason we were not notified of it, as promised, and the result was that we have to abide by results from this test, regardless of poor blocks which were made by block makers who were novices at the business. Good machine mixed blocks with the proper amount of cement would, in my opinion, have given us a satisfactory rate.

Other papers were presented as follows, some of which will appear later: "Specifications for Cement Blocks," by F. L. Dykema; "Freight Classifications for Cement Machinery," by J. F. Angell; "Foreign

Trade," by M. Wetzstein, "Concrete Block Architecture," by A. T. Bradley; "Ornamental Products," by E. C. Harter; "Advertising," by S. J. Young; "Cast Stone," by C. W. Stevens. There were many short addresses and the discussions were quite spirited. R. R. Fish gave a demonstration of the Medusa waterproofing compound of the Sandusky Portland Cement Company, and M. M. Smith, the chemist and general manager of the Art Portland Cement Company, Kimmell, Ind., gave a talk, illustrated with samples of work, regarding the white Portland cement which this company expects to put on the market shortly.

In the executive session the name of the organization was finally changed to the National Concrete Machinery Manufacturers' Association, and the officers elected were J. F. Angell, President; O. U. Miracle, Vice-President; Sid L. Wiltse, Secretary, and Mentor Wetzstein, Treasurer.

The Association also decided to join the National Fire Prevention Association, for the purpose of pushing the insurance question. A fire insurance committee was appointed, consisting of S. L. Wiltse, J. F. Angell, A. T. Bradley, F. L. Dykema and R. Pulfer, to co-operate with the National Fire Preventative Association, and two members of this committee will represent this Association in New York at the Fire Prevention Association meeting in May.

The Association decided that its members would no longer tolerate the matter of sending their concrete machinery out on trial, as all purchasers of machinery manufactured by members of this Association must in each and every instance pay at least some money on the machine when they order.

A committee was appointed consisting of Mr. Dykema and Mr. Miracle, to revise the concrete block machine manufacturers' specifications for concrete blocks, to include brick, and see that said specifications were circularized to all the important cities and towns of the United States, and for the purpose of getting them to adopt these specifications for the manufacture of brick, blocks and concrete products, as by adopting such specifications a manufacturer of this material could not help but make good concrete blocks and concrete products.

It was the unanimous decision of the members present to put forth every effort to inform every one of their customers on the special point of taking particular pains to see that they put some cement in their blocks and brick and make nothing but the best, as the insurance people will not give a good rate on this product, especially blocks, until this is done. No more mud blocks, or in other words, blocks without cement in them, will go. If they cannot be made right, it is the sense of this Association that they not be made at all.

Those present at the meeting included: R. R. Fish, Sandusky Portland Cement Company, Sandusky, Ohio; C. D. Frederick, Columbus, Ohio; E. T. Rose, Columbus, Ohio; J. F. Angell, Winget Concrete Machine Company, Columbus, Ohio; John Monaghan, Alpena Portland Cement Company, Alpena, Mich.; Samuel J. Vail, Samuel J. Vail & Co., builders' supplies, Detroit, Mich.; M. Wetztein, Ideal Concrete Machinery Company, South Bend, Ind.; Charles W. Stevens, Harvey, Ill.; Robert Seibert, Art Portland Cement Company, Syracuse, Ind.; G. B. Pulfer, Ideal Concrete Machinery Company, South Bend, Ind.; E. T. Bradford, Chicago, Ill.; A. T. Bradley, Rochester, N. Y.; J. Augustine Smith, Detroit, Mich.; C. O. White, Jackson, Mich.; F. L. Dykema, Dykema & Son, Grand Rapids, Mich.; E. C. Harter, Cement Working Machinery Company, Detroit, Mich.; O. U. Miracle, Miracle Pressed Stone Company, Minneapolis, Minn.; Richard L. Humphrey, St. Louis, Mo.; H. S. Palmer, Palmer Manufacturing Company, Washington, D. C.; Kirk H. Brown, Detroit, Mich.; G. B. Miles, P. B. Miles & Co., Jackson, Mich.; W. P. Butler, Minneapolis; C. L. Stillman, Detroit Concrete Stone Company, Detroit, Mich.; William Seafert, *Cement and Engineering News*, Chicago, Ill.; Walter C. Boynton, and E. B. Walfrom, *Concrete Publishing Company*, Detroit, Mich.; W. A. Binkley and E. R. Cooledge, *Southern Lumberman*, Nashville, Tenn.; Edgar H. Defebaugh, *The Barrel and Box and Rock Products*, Louisville, Ky.; W. P. Cosgrove, MUNICIPAL ENGINEERING, Indianapolis, Ind.; H. C. Green, Columbus, Ohio; E. B. Hoy, *The National Builder*, Chicago, Ill.; B. H. Rader, Illinois Steel Company, Chicago, Ill.; William Reuther and O. F. Byxbee, *American Carpenter and Builder*, Chicago, Ill.; E. P. Schmidt, *Cement Era*, Detroit, Mich.; S. L. Wiltse, Cement Machinery Company, Jackson, Mich.; M. M. Smith, Art Portland Cement Co., Kimmell, Ind.

Technical Meetings.

The fourth congress of the International Association for Testing Materials will be held at Brussels, Belgium, Sept. 3 to 8.

The convention of the American Civic Association will be held in Milwaukee, Wis., some time in October, although the exact date has not yet been determined on.

The thirty-second convention of the International Association of Fire Engineers will be held at Dallas, Texas, Oct. 9, 10, 11 and 12.

The annual convention of the New England Water Works Association will be held at the Febyan House, White Mountains, N. H., Willard Kent, Narragansett Pier, R. I., sec'y.

The annual convention of the Ameri-

can Street and Interurban Railway Association will be held at Columbus. Ohio, Oct: 15 to 19. Bernard V. Swenson, 60 Wall st., New York city, sec'y.

The Union of Canadian Municipalities met at Halifax, N. S., Aug. 14, 15 and 16. An excellent program was presented, among the subjects on the list being "A Municipal Central Power Station," "Water Filtration," "The Value of Municipal Markets," "Poles, Wires and Conduits in Toronto," "Shade Trees in Our Cities." "Franchise Troubles," "Municipal Ownership," "The Advantage of Good Roads," "The Wants of a Rural Municipality," "Municipal Telephones," "Municipal Electric Lighting."

The next meeting of the Association of American Portland Cement Manufacturers will be held at the Auditorium Hotel, Chicago, Ill., Sept. 10, 11 and 12. The program of the third day, beginning at 10:30 a. m., is open to the public and includes a stereopticon talk by Richard L. Humphrey on "The Behavior of Structural Materials Under Earthquake Shock and Fire at San Francisco," and papers by S. B. Newberry on "The Work of the German Association of Portland Cement Manufacturers," and by Carl Weber on "The Construction of Concrete Steel Chimneys."

Civil Service Examinations.

The U. S. Civil Service Commission announces the following examinations to be held at the usual places:

For aid in the Coast and Geodetic Survey at $720 a year. on Sept. 12 and 13.

For constructing engineer in the reclamation service of the Geological Survey, at $150 to $250 a month. most of them in the West, on Oct. 1.

For engineer draftsman in the reclamation service, Geological Survey, at $1,500 to $2,000 a year, on Sept. 12, 13 and 14.

For engineman, quartermaster's department-at-large, Ft. McKinley, Me., at $1,000 a year, on Sept. 5.

Personal Notes.

S. T. Mann has been appointed city engineer at New Albany, Ind.

E. R. Beckwith has been appointed city engineer at Ottawa, Canada.

George Y. Craig has resigned as assistant city engineer at Omaha, Neb.

Harry M. Gates, C. E., Columbus, O., died in that city at his home, Aug. 15, of heart disease.

A. C. Greaves, city engineer at Spencer, Ia., has accepted a similar position at Sturgeon Bay, Wis.

E. C. Beach has resigned his position as general manager of the gas company at East St. Louis, Ill.

Arthur H. Pratt has been appointed assistant engineer by the Board of Water Supply of New York city.

Homer Hamlin has been appointed city engineer at Los Angeles, Cal., to succeed Harry F. Stafford, deceased.

Ernest R. Beckwith has been appointed city engineer at Kingston, Ont., to succeed H. B. R. Craig, resigned.

Hon. P. D. Rowe, mayor of Orting, Wash., for the last two years, died Aug. 14 of cancer of the stomach, aged 54 years.

George P. Coleman, city engineer of Winona, Minn., to accept a position as assistant to the State Highway Commission of the State of Virginia.

A. Mason Garner has been elected a member of the City Council at Fredericksburg, Va., to fill the vacancy caused by the death of W. L. Watson.

A. L. Southard, C. E., died at his home in Chicago, Ill., July 29, aged 60 years. Mr. Southard built the first railway in South America to cross the Andes.

W. A. Newman, formerly county surveyor, has been appointed superintendent of public works at Lexington, Ky., to succeed Patrick Mooney, resigned.

Albert W. Fiero, a member of the firm of Robert Hunt & Co., inspecting engineers of Chicago, Ill., died at Battle Creek, Mich., July 28, after an illness of three months.

James Richard DeRemer, C. E., died of paralysis at Denver, Colo., July 26, aged 59 years. Mr. DeRemer built the hanging bridge on the line of the Denver & Rio Grande R. R. through the Royal Gorge, in Colorado.

Alexander J. Taylor, superintendent of public parks at Wilmington, Del., has been appointed engineer in charge of sewers of that city, to succeed George Rommel, Jr., resigned.

A. F. Gill, consulting engineer for the water service improvements at Spokane, Wash., resigned to become associated with the Independent Paving Company, with headquarters in Spokane.

Arthur Chester, an engineer connected with the new sewerage system being constructed at Cape May, N. J., was overcome by gas in a manhole, Aug. 13, and died before he could be released.

Hon. James S. Neville, mayor of Bloomington, Ill., died Aug. 15, at the West Baden Hotel, West Baden, Ind., where he had gone to recuperate from what was thought to be a slight illness.

A. E. Morrison has resigned as registrar at the State University of North Dakota, at University, N. D., his resignation to take effect Sept. 10, 1906, to accept an engineering position at Calgary, Alberta.

The Board of Water Commissioners, created by the Legislature of New York, has appointed J. F. Witmer, of Buffalo, N. Y., as constructing engineer and superintendent to plan a new water system for the town of Corning, N. Y.

John Ericsson, formerly chief engineer of the city of Chicago, has been appointed representative of that city in lowering the La Salle, Washington and Van Buren street tunnels under the Chicago river. The Union Traction Company is doing the work.

Harry F. Stafford, city engineer of Los Angeles, Cal., died in that city Aug. 3, of asphyxiation, as the result of the explosion of a gas heater. Mr. Stafford was 42 years old and was serving his third term as city engineer at the time of his death.

F. D. Meacham, president of the Meacham & Wright Cement Company, Chicago, Ill., collapsed from overwork, Aug. 17. His condition is considered by the physicians as serious. He has been removed to his summer home at Lake Geneva. Mr. Meacham is 64 years old.

B. R. Craig has resigned as city engineer of Kingston, Ont., to become resident engineer of the Grand Trunk Pacific Railway west of Fort. William.

Mortimer E. Cooley, M. Am. Soc. C. E., head of the mechanical department of the University of Michigan, has been retained by the Omaha Water Board as an appraiser to act in conjunction with two other appraisers to determine the value of the Omaha Water Company's plant.

Prof. Mansfield Merriman, of Lehigh University, has been granted a leave of absence for one year, and will practice as consulting engineer. He will be associated with Clarence W. Hudson, who has resigned as assistant engineer of the Phoenix Bridge Company, and the new firm will establish an office at 45 Broadway, New York city. Particular attention will be given to the hydraulics of water power, water supply and sewerage, and to bridges, structures and engineering materials.

MACHINERY AND TRADE

Asphalt Mastic.

Gabriel & Schall, 205 Pearl street, New York city, have secured a registered trade-mark on their initials on a cylindrical cake of Brunswick asphalt mastic, so that this brand, which has been so favorably known on the market for the past 25 years, may be distinguished from others which imitate the form and other unprotected features of the cake form used for marketing the product.

Brunswick asphalt is used for floors in warehouses, stables, kitchens, cellars, hospitals, railroad stations, etc., and for paving, roofing and fluxing, there being two forms for the latter uses, one hard 78 per cent. asphaltum and one Goudron, soft, 95 per cent. bitumen. The product is manufactured from selected raw materials obtained from the mines of the Vorwohle Asphalt Co., Escherhausen, Germany, with the addition of double refined Trinidad Lake asphalt.

Consolidation of Concrete Block Machine Companies.

The H. S. Palmer Hollow Concrete Building Block Company, of Washington, D. C., has purchased the entire interests of the Cement Machinery Company, of Burlington, Iowa, including all their patterns, patents, office fixtures and good will, and J. W. Sanderson, manager of the Cement Machinery Company for the past two or three years, will be identified with the H. S. Palmer Company.

The Palmer Company will shortly issue a catalogue of both new and second-hand machinery which has been taken from the Cement Machinery Company, and which will be sold cheap and guaranteed to be first-class.

An Indestructible Enameled Street Sign.

We have received a sample of a new design for an enameled steel sign which has some marked improvements. The base of the sign is a wooden back about 7-8 inch thick and 3 3-8 inches wide, and beveled at the ends, the outer or longer face being the length of the sign as determined by the length of name of the street. This wooden back can be nailed or otherwise fastened to the house, tree or post to support the sign. The sign itself is a steel plate enameled in blue with white letters. The side edges are turned over to slip over the wooden back and have four large screw holes near the ends. The ends of the turned over sides are beveled at the same angle as the back of the board. When slipped over the wooden back the enameled sign is held in place with four found-headed brass screws, with emphasis on the brass. Leather washers are put between the enamel and the brass heads and they are not screwed up too tight, because the steel plate will expand and sufficient play must be left so that it will not buckle. This prevents any undue strain on the enameled surface and thus vastly lengthens its life, in fact, gives basis for the term indestructible as applied to this sign. The company there-

fore guarantees that the signs will stand all climatic changes and will not color, fade or tarnish. Soap and water can be used for cleaning them.

Signs are made in all styles to suit special requirements. For example, one city sets four signs on iron brackets on a trolly pole at each corner, thus showing the street names from every direction. Another puts the signs along the supporting post instead of horizontally across it, and puts one on each of its four sides.

Ornamental corner pillars are furnished for holding signs, made of hollow metal with a solid bed plate in the ground and double brackets for holding two or more signs ten feet above the ground. Lamps of any kind can be put on top of these pillars. Signs for telegraph, telephone, railroad, street car, newspaper, contractor, wagon, express, real estate purposes, public notices, advertising, etc., are also supplied as well as white enameled letters, crystal glass and metal letters for window and other signs, house numbers and all kinds of door plates. An illustrated catalogue will be sent on application to the Pacific Sign and Enameling Co., Los Angeles, Cal., and the prices quoted in it will be quite as interesting as the signs described.

Wall Ties.

The accompanying cuts show several designs of wall ties manufactured by O. D. Levering, 82 N. Fourth st., Columbus, O., which are well worth attention.

The Standard tie is one inch wide and No. 12 gauge in thickness. The Ohio is 5/8 inch wide and No. 20 gauge. Either is made 7, 9, 10 and 11½ inches long. They are made from selected sheets of well galvanized steel. The corrugations do not extend the full width of the strip, but a narrow unformed edge is left on each side, thus preventing stretching of the tie.

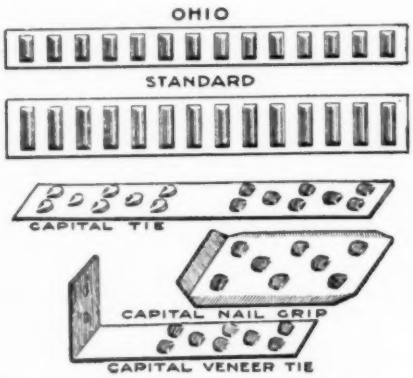
The Capital ties are made from the same high grade of material. They have large semi-circular projections struck up from the body of the metal into which the mortar presses, thus making a very strong bond. The Capital face brick and veneer ties are one inch wide and No. 20 gauge. The veneer ties are bent, as shown, or are straight. Lengths are from 6 3-4 to 11 1-2 inches.

The Capital nail grip, of the same material, is concaved slightly on one side, so that when placed next the brick there is just space enough between them to give a nail a powerful grip when one is driven in. This insures a firm nailing base. Mr. Levering also makes Buckeye and Columbus galvanized wire wall ties for use in tieing up face brick, veneering and hollow walls. He will send an illustrated circular and net price list on application.

Trade Publications.

A. G. Spalding & Bros. issue a catalogue of outdoor gymnastic apparatus, showing much which is available for public parks and playgrounds.

The Association of American Portland Cement Manufacturers, 1232 Land Title Bldg., Philadelphia, Pa., has issued butletin No. 11 on "Cost Reduction of Reinforced Concrete Work," by E. P. Goodrich, M. Am. Soc. C. E., and No. 12, entitled "The Progress and Logical Design of Reinforced Concrete," by Ross F. Tucker, M. Am. Soc. C. E., extracts from both of which appear elsewhere in MU-



LEVERING'S WALL TIES AND NAIL GRIPS.

NICIPAL ENGINEERING. The bulletins will be sent on application to the office of the Association.

"Tarvia, the Dust Layer." is the subject of a new booklet of the Barrett Mfg. Co., which contains an illustrated report of the successful experiments with this materials at Jackson, Tenn., by U. S. officials, as described in a previous number of MUNICIPAL ENGINEERING.

Loose-leaf devices are illustrated in a pamphlet issued by the Sieber & Trussell Mfg. Co., St. Louis, Mo.

C. W. Hunt Company, West New Brighton, N. Y., sends pamphlet 064 on industrial railways.

The Buffalo Forge Company, Buffalo, N. Y., send a pamphlet on their fan system of heating and ventilating, with the announcement of a new office at 403 Neave Bldg., Cincinnati, O., in charge of A. J. Vance.

The Economy Drawing Table Co., Toledo, O., issue a well illustrated cata-

logue of economy drawing tables, sectional filing cases and special furniture in this line which is well worth asking for.

The Buffalo Testing Laboratory, 702 Ellicott square, Buffalo, N. Y., announces its offiffice and business on a blotter.

The University Bulletin of the University of Michigan, for July, is devoted to the general announcement of the Department of Engineering for the coming year.

Catalogue xix., of the Chicago Pneumatic Tool Co., Fisher bldg., Chicago. Ill.. shows the Keller pneumatic stone tools, including surfacers, drills and carving tools, air compressors and air receivers. A postal card will bring it.

The Safety Meter Lock Co., Columbus. O., issue a booklet on seals for meters which contains much information on this subject.

Berger's wireless prong lock system of steel studs and furring for fireproof partitions and ceilings, is handsomely illustrated and described in a catalogue issued by the Berger Mfg. Co., Canton, O.

Many practical hints of value to cement users are contained in a booklet, "American Concrete Mixers," just issued from the offices of the International F. and Fireproofing Company, Columbus, Ohio. The catalogue is a good example of the printer's art and is full of information. As a dissertation upon concrete mixing in general the booklet is of value, and as an exposition of the methods of this particular mixer it canot but prove of interest to those interested in the purchase of a machine. A postal card sent to the company will secure one of the booklets.

The Miracle Pressed Stone Co., Minneapolis, Minn.. issues a small catalogue of cement worker's tools for sidewalks, curbs and similar work, including hoes, barrows, sieves, etc. This company has a sidewalk tile machine and a cement brick machine.

Trade Notes.

ASPHALT.

Kansas City, Mo.—The purchase of an asphalt repair plant is contemplated.

Wichita, Kan.—Missouri capitalists are reported as being interested in a scheme to erect a plant for the manufacture of asphalt paving blocks in this city. The estimated cost of the plant is $100,000.

BRICK.

Fredericks, Md.—The Maryland Brick and Supply Co. is erecting a brickmaking plant here at a cost of $45,000.

Rome, Ga.—The Rome Brick Co. closed a contract recently with Chambers Bros. Co., of Philadelphia, for an entire new equipment of clay preparing and stone extracting machinery.

Bastrop, Tex.—The Texas Fire Brick Co. has been incorporated by Earl Schwartz, of Corsicana, and C. C. Wilson, of Denver, Colo.

Canton, Ill.—W. W. Ellis & Son have leased a tract of land near here and will remove the plant of the Canton Brick and Tile Co. to the new location. The manufacture of paving brick will be undertaken on a large scale, in addition to building brick and tile.

Portsmouth, O.—The Portsmouth Pressed Brick Co., a new paving brick concern, has been incorporated here by H. S. Grimes, S. Labold, D. W. Conroy, W. L. Hitchcock and Wm. Coriell.

CEMENT.

Ada, I. T.—The erection of a large cement plant is contemplated by northern capitalists, according to press reports. The city has agreed to procure a water supply for the new enterprise.

Montrose, Colo.—Edward Duryee, cement expert for the U. S. Reclamation Service, has been examining the country near the Government's great works here, to ascertain the feasibility of the manufacture of cement for the Gunnison tunnel and the Uncompahgre canals.

Mt. Sterling, Ky.—The Patrick Cement Co. will build a large modern cement plant at Stanton, in Powell County. The plant will cost $35,000 and will have a capacity of 500 barrels daily. It will be completed by January 1. The company is composed of J. C. Patrick, K. S. Bohannon and J. D. Atkinson.

Chicago, Ill.—The Secretary of the Interior has awarded the contract for furnishing 40,000 barrels of Portland cement for use in constructing the North Platte, Neb., and Shoshone, Wyo., irrigation prospects, to the Illinois Steel Co., of this city, at $1.40 per barrel.

Birmingham, Ala.—Geo. W. Cater, Jr., of Meridian, Miss., is negotiating for the placing of $125,000 worth of stock in this city for a new cement plant to be established at Epes, Ala. The new corporation is the Monona Portland Cement Co., of which A. G. Parrish, of Selma, Ala.. is president.

Cement, Ga.,—The Hydraulic Cement Co., of this place, has completed and put in operation a plaster mill, at a cost of $25,000. The company has also erected two additional kilns.

Chanute, Kas.—The Chanute Cement and Clay Products Co. will erect a Portland cement plant here at a cost of $2,500,000.

Kansas City, Kas.—The Guthrie Mountain Coal and Cement Co. has been organized here and will build a Portland cement plant and a vitrified block plant at Mapleton, 18 miles northwest of Ft. Scott. Samuel T. McDermott, of this city, is president; Elwood C. Hepler, Ft. Scott, vice-president; Eugene E. Edwards, Chicago, secretary and treasurer.

Charlotte, N. C.—The Briar Creek Brick and Cement Co. has been incorporated to manufacture and deal in brick, cement, concrete blocks, sand, clay, etc., by J. B. McLoughlin, J. P. Carr, R. J. Foil, W. S. Pharr and J. H. Ross.

Fortine, Mont.—The Montana Cement and Lumber Co. has been organized to establish a cement plant and lumber mills here.

Oklahoma City, Ok.—A new cement company has been incorporated and will engage in the manufacture of cement,

lime and other building material. The plant will be located in the Indian Territory, but the general offices will be here. Those interested in the new enterprise are Adam L. Beck, Peter Martin and Edwin Harter, of Huntington, Ind.; M. McKinley and Heber P. Harter, Oklahoma City.

Toronto, Ont.—The Great Lakes Portland Cement Co. has been granted a charter by the Ontario Government, with head offices in this city.

New Hamburg, N. Y.—The New Hamburg Keene Cement and Lime Co. has been incorporated.

Wellston, O.—C. D. Quick has been appointed superintendent of the works of the Alma Cement Co. here, to succeed J. N. Kennedy, resigned.

Cheyenne, Wyo.—Charles P. Williaks, of the U. S. Geological Survey, is investigating raw cement materials in this State, and a Government cement plant may be built in the vicinity of Absaraka Park, near here.

Marion, Ky.—The Southern Gypsum Co. has been incorporated here.

Los Angeles, Cal.—The high price of cement here has caused the Board of Public Works to consider the erection of a Portland cement plant, for the purpose of manufacturing the cement required in constructing the Owens River conduit, which will furnish the city its water supply.

Los Angeles, Cal.—The Cement and Iron Mfg. Co., of this city and Lindcove, in Tulare County, contemplates the erection of a modern cement plant on a 2,000-acre tract of land near Lindcove.

Hagerstown, Md.—Frederick A. Wright, of New York city, has purchased the J. T. Richards limestone track of 124 acres at Pinesburg, and will organize a company to open quarries on the tract and manufacture cement, burnt lime, etc.

Lancaster, Pa.—The Constoga Portland Cement Co. has been incorporated to develop cement deposits at Millway, 10 miles from here.

Rapid City, S. D.—A company has been formed here to establish a cement plant. James Halley, pres't.; Victor E. Jepson, sec'y.

Calgary, Alta., Canada.—The plant of the Calgary Portland Cement Co. was destroyed by fire recently.

Samples of western Portland cement are being secured from different plants, according to press reports, by the Edison interests, in order to make tests of the poured concrete cottage plan recently announced by T. A. Edison.

Mason City, Ia.—The Iowa Portland Cement Co. has been incorporated with officers as follows: President, George Nicholson, Iola, Kas.; vice-president, A. B. Cockerill, Nevada, Mo.; secretary, J. C. Burch, Chicago. A plant of 2,500 barrels daily output will be erected at once.

CONCRETE BLOCKS.

Virginia, Minn.—The Northern Cement Construction Co., which has been operating a concrete plant at Hibbing, will establish a plant here. Frank Williams will have charge of the plant.

Clinton, Ia.—The Mississippi Valley Burial Vault Co. has been incorporated to manufacture cement burial vaults. J. E. Moran and other business men are interested.

Los Angeles, Cal.—A large reinforced concrete freight depot will be erected by the Santa Fe Railway Co.

Chicago, Ill.—The Rudolph S. Blome Co. has been awarded contracts for several thousand square yards of their special granitoid concrete block pavement in the yards of the Knickerbocker Ice Co. and for a large amount of asphalt floor and concrete work for various companies in Chicago.

Imogene, Ia.—Daniel Bussard has invented a machine for making cement blocks. He will engage in the manufacture of cement building blocks.

Pittsburg, Pa.—The plant of the Concrete Stone and Sand Co., 935 Poland ave., was nearly destroyed by fire recently.

Struble, Ia.—A cement post plant has been put in operation.

Petoskey, Mich. — Special. — Koepke Bros., 112 Howard st., advise us that they are figuring on a reinforced concrete building, or a building having reinforced concrete and tile floors, in which Kahn bars are used. They desire information as to the price per square foot for such floors, and desire to correspond with a good consulting engineer on the subject.

NEW CONCRETE BLOCK COMPANIES.

Hillsboro, Ill.—Hillsboro Artificial Stone Co.—H. E. and J. M. Haag and H. R. Crawford.

Highland, Wis.—Highland Hollow Concrete Wall Co.—T. P. Kennedy, Walter B. Potter, Calvert Sprensley.

New Orleans, La.—Southern Cement Stone Co., Ltd.—T. L. Volz, Louise Volz, Sheldon Lynne.

Joliet, Ill.—Joliet Concrete Construction Co.—Alonzo C. Brown, Robert C. Morrison, John Strombeck.

Elgin, Ill.—Illinois Hydraulic Stone and Construction Co.—Carl J. Seagren, A. C. Seagren, H. A. Lech.

Chicago, Ill.—Rock River Construction Co.—W. H. Troyer, W. N. Bayliss, D. H. Mosteller.

Rochester, N. Y.—Cement Products Co.—Peter J. Harkins, Robert N. Curtis, George A. Cooley, Alfred W. Curtis.

Bronson, Minn.—R. A. Rubert.

Emmetsburg, Ia.—H. Shadbold.

Hawley, Minn.—Lewis Bros.

Janesville, Minn.—Bradford Chase.

Sauk Rapids, Minn.—Albert Biangia.

Belmond, Ia.—Belmond Cement Mfg. Co.

Rapid City, S. D.—Keown Bros. & McManus.

Stratford, Ia.—T. H. Shaeffer.

Bovey, Minn.—J. F. Freestone.

Springfield, Minn.—Hansen & Averson.

Clarkston, Wash.—Potter & Wickersham.

Spokane, Wash.—San Poil Cement Plaster Co.

Glencoe, Minn.—George McAllister.

Canton, Miss.—J. A. Tull and others have incorporated the Canton Concrete Co.

South Bend, Ind.—The Ideal Concrete Machinery Co. has begun the manufacture of its Ideal block machines in Canada, the factory and office being situated at 124 York st., London, Ont. The demand for the machines that poured in from Canadian provinces made it necessary to begin the manufacture of them in that country. The office is in charge of F. M. Leach. Machines are already being produced and shipments of Canadian orders are being made.

PURCHASE OF MACHINERY.

North Platte, Neb.—Special.—The North Platte Cement Co. is in the mar-

ket for machinery and tools for cement building and fireproofing, and ornamental cement work.

St. Catherines, Ont.—Special.—S. W. Michener, 18 Welland ave., advises us that he is in the market for machinery and tools for making hollow concrete blocks and ornamental pier blocks and pillars.

Cleveland, O.—Special.—Dan McKisson, 3822 Denison ave., desires to purchase machinery and tools for road building and concrete work.

Murphysboro, Ill.—Special.—A. L. Smith, 1906 Elm st., advises that he is in the market for cement sand brick machinery, cement sand block machinery, and a power sand screen.

Groton, S. D.—Special.—George H. Niemeyer advises us that he is in the market for all kinds of tools for general cement work.

Red Cloud, Neb.—Special.—F. W. Studebaker desires to purchase a cement mixer.

Greensburg, Ky.—Special.—John A. Hobson desires to communicate with manufacturers of concrete block machinery.

Esmond, N. D.—Special.—E. C. Laing is in the market for machinery and tools for concrete building.

Milwaukee, Wis.—Special.—The Graham Construction Co., 406 Free Press Bldg., is in the market for concrete machinery and tools.

Marshall, Minn.—Special.—Ryden & English are in the market for machinery and tools for sidewalks, building blocks, tile and posts.

Owensboro, Ky.—Special.—The Eigemann Contract Co., 8 Locust st., desires to purchase a dump wagon and a concrete wagon.

Darlington, Wis.—Special.—Ed Stott advises us that he is making brick with the Helm press.

Lock Haven, Pa.—Special.—The Lock Haven Construction and Concrete Co. is in the market for mixers, block machines and screens.

Memphis, Mo.—Special.—H. H. Schenk advises us that he desires to purchase machinery and tools for making cement land drain tile and a sand washing machine.

St. Cloud, Minn.—Special.—Geo. L. Vesconte, 122 Fourth ave., is in the market for machinery for making concrete conduit for conveying water for irrigation purposes.

Biloxi, Miss.—Special.—John F. Peppard, P. O. Box 206, advises us that he is in the market for concrete block molds and tools.

Kansas City, Mo.—Special.—J. G. Harper & Son, 2008 McGee st., advises us that they desire the agency for some good mixer, brick and block machine.

Peru, Ind.—Special.—A. J. Bruck, W. 12th st., desires to purchase cement block machines and mixers.

Bemidji, Minn.—Special—M. D. Stoner, cy. engr., desires to correspond with companies making the latest devices in flush tanks.

Eaton, O.—Special.—A. L. Armstrong advises us that he is in the market for machinery and tools for making blocks, brick, posts, etc., veranda columns and ornamental designs.

PURCHASE OF MATERIALS.

Cleveland, O.—Special.—Dan McKisson, 2833 Denison ave., desires to purchase cement and reinforcing materials.

Murphysboro, Ill.—Special.—A. L. Smith, 1906 Elm st., is in the market for lime, sand, brick, cement, hard plaster and crushed granite.

Groton, S. D.—Special.—Geo. H. Niemeyer desires to purchase sand and cement coloring.

Esmond, N. D.—Special.—E. C. Laing desires to purchase cements, plaster, etc.

Marshall, Minn.—Special.—Ryden & English are in the market for Portland cement.

Anderson, S. C.—Special.—J. J. Trowbridge is in the market for cement.

Lock Haven, Pa.—Special.—The Lock Haven Construction and Concrete Co. is in the market for cement, etc.

Griffin, Ga.—Special.—Allan Little desires to purchase concrete building blocks.

Memphis, Mo.—Special.—H. H. Schenk advises us that he is in the market for Portland cement.

St. Cloud, Minn.—Special.—Geo. L. Vesconte, 122 Fourth ave., is in the market for reinforcing materials for making a concrete conduit for conveying water for irrigation purposes.

Biloxi, Miss.—Special.—John F. Peppard, P. O. Box 206, is in the market for cement and cast iron.

Peru, Ind.—Special.—A. J. Bruck, W. 13th st., desires to purchase cement.

Indianapolis, Ind.—Special.—J. K. Lilly, of Eli Lilly & Co., is in the market for about 100 concrete fence posts suitable for stretching wires upon to sustain grape vines.

MISCELLANEOUS.

Chicago, Ill.—The United States Crushed Stone Co. has been organized by Hugh J. Kearns, Chas. A. Klotz and Perry Kenworthy.

Iola, Kas.—The Endurite Co. will build a plant here. Dr. H. V. Dresbach is president of the company. Endurite is said to make an indestructible pavement.

Albany, N. Y.—The McDonald Meter Co. will build a new plant on Lancaster ave.

Gary, Ind.—The Indiana Steel Co. has awarded to the Great Lakes Dredge and Dock Co., of Chicago, the contract for constructing harbors and docks here.

Chattanooga, Tenn.—The Chattanooga Sprinkling Co. has been incorporated by A. T. Whiteside, S. B. Smith, W. D. Carswell, V. Burleigh Whiteside and J. G. Dobbs.

Dallas, Tex.—The Municipal Paving Co. has been incorporated with F. O. Brown as president, and B. R. Anderson as secretary-treasurer.

SEWER PIPE.

Texarkana, Tex.—The Post Pipe Co. has completed its first kiln of sewer pipe. The company invites correspondence and orders from builders' supply dealers, particularly those located in the Southern States.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Herkimer, N. Y.—This village has been restrained from entering into contract with the Warren Brothers' Bithulithic Paving Co. for paving a portion of N. Washington st., on the ground that bid accepted was the highest submitted.

Omaha, Neb.—Andrew Rosewater, city engineer, has succeeded in reaching an agreement with the Barber Asphalt Paving Co., whereby it will stand half the cost of regrading and repaving Burt st., between 39th and 40th sts., where the asphalt has been destroyed by the street sinking 2 feet or more by the washing out of the earth on filled ground. The grading for the original work, however, was done by the city and the paving company is not responsible for the damage. The Barber Company was not the company that did the work first, but succeeded to the maintenance contract. About 1,100 yards of surface are involved and the total cost will run from $2,000 to $2,500.

Washington, D. C.—The second set of bids for new sheet asphalt paving were received Aug. 3, and after careful examination by Engineer of Highways Hunt, he stated that the proposals were practically identical with the ones previously submitted, and that all were in excess of the limitations imposed by law. In making an appropriation of $20,000 for the work, Congress specified that the sheet asphalt should not cost more than $1.65 a sq. yd., but in either set of bids the price did not come within this limit. In the bids received Aug. 3 the Brennan Construction Co. proposed to lay sheet asphalt at $1.65 a sq. yd. on the condition that they were also awarded the contract for vitrified block paving at $3.43, and the Cranford Paving Co. agreed to do the work at $1.98 for sheet asphalt and $1.35 for vitrified block. Engineer Hunt characterized the bid of the Brennan Construction Co. as "unbalanced," and claimed that $1.30 would be a fair price for vitrified block. The Barber Asphalt Co. declined to enter into competition for the work on account of the limit of cost as specified, in connection with the increased cost of labor and the condition of the market governing commodities which enter materials for street improvements. No more bids will be asked for this year.

CONTEMPLATED WORK.

Key West, Fla.—Street paving is contemplated.

Verndale, Minn.—Cement walks are contemplated.

Emmetsburg, Ia.—Cement sidewalks will be built.

De Pere, Wis.—Cement sidewalks are contemplated.

Appleton, Wis.—Cement sidewalks are contemplated.

Omaha, Neb.—Repairing is proposed for Farnham st.

Churches Ferry, N. D.—Cement sidewalks are proposed.

La Moure, N. D.—Permanent sidewalks are contemplated.

Memphis, Tenn.—Johnson ave. will be paved with asphalt.

Hutchinson, Kan.—Paving is contemplated for an alley.

Dubuque, Ia.—Brick paving is contemplated for 8th st.

Big Fork, Minn.—Voted $8,000 for road improvement work.

Little Falls, Minn.—Paving is contemplated for 1st st.

Davenport, Ia.—Brick paving is contemplated for two alleys.

Laurens, Ia.—Council has ordered the construction of sidewalks.

Green Bay, Wis.—Asphalt paving is contemplated in Adams st.

Menominee, Mich.—Street improvements are proposed by Council.

Eveleth, Minn.—The question of cement walks is being agitated.

Britton, S. D.—The construction of brick sidewalks is contemplated.

Dallas, Tex.—The question of paving Kentucky st. is being discussed.

Ellendale, N. D.—Cement sidewalks in a number of streets are contemplated.

St. Joseph, Mich.—About 1 mile of brick paving is contemplated. Cy. clk.

St. James, Minn.—Cement sidewalks are contemplated on several streets.

Missoula, Mont.—Council has ordered additional cement walks constructed.

Ludlow, Ky.—Macadam paving is contemplated for Locust st. from Elm to Ash.

Pewaukee, Wis.—Cement walks will be constructed at the school building.

Marshall, Tex.—Voted to issue $90,000 sidewalk and street paving bonds.

Walker, Ia.—Council has authorized the construction of permanent sidewalks.

Springfield, Ill.—Ordinances have been passed for paving Grand ave. and Dodge st.

Colorado Springs, Colo.—About 10 blocks more of cement sidewalks are contemplated.

Oakley, O.—Bids are asked until Sept. 10 for $5,000 sidewalk bonds. W. E. Leilkop, vil. clk.

Palatine, Ill.—About 1-2 mile crushed stone paving is contemplated. A. L. Olms, mayor.

Sandusky, O.—Bids are asked until Sept. 14 for the purchase of $25,000 paving bonds.

Green Bay, Wis.—City Council decided, Aug. 17, to pave Monroe ave. and Madison st. next year.

St. Augustine, Fla.—Vitrified brick paving is contemplated for about 1 mile of San Marco ave.

Richmond, Ind.—A resolution was adopted Aug. 10 to construct cement sidewalks on Linden ave.

Bloomington, Ind.—The question of improving the streets with bitulithic is being considered.

Pelican Rapids, Minn.—Council has or-

dered the construction of cement curbs and alley crossings.

Farmville, Va.—High st. is to be paved with stone and granolithic sidewalks from Main to St. George.

Hamilton, O.—Bids will be asked for about 50,000 sq. yds. of street improvement. L. A. Dillon. cy. engr.

Aurora, Ill.—An ordinance has been passed to pave N. River and Walnut sts. with brick and cement curbing.

Fairfield, Ia.—The property owners have been directed to build 100 cement sidewalks. Wm. Long, cy. clk.

Orlando, Fla.—This city is considering the issue of $12,000 bonds for paving the streets with brick.

Selina, Ala.—The Commercial and Industrial Associations are arguing the question of paving Broad and Water sts.

Denver, Colo.—An ordinance has been passed creating East Side improvement district No. 1. R. W. Speer, mayor.

Knoxville, Tenn.—Asphalt, vitrified brick, bitulithic and other paving is contemplated. W. C. Crozer, cy. engr.

New Orleans, La.—The paving of the banquettes on both sides of Hagan ave. from Canal to Perdictor, is contemplated.

Elberton, Ga.—Plans and specifications are being prepared for paving several blocks of McIntosh st. with vitrified brick.

Burlington, Ia.—A resolution has been passed to construct cement sidewalks. F. L. Unterkicker, mayor; Robt. Kroppach, cy. clk.

Elkhart, Ind.—Resolutions have been adopted for constructing cement sidewalks on certain streets. Ethan L. Arnold, chrm. B. P. W.

New Orleans, La.—The city engineer has been directed to prepare plans and specifications for paving Howard st. with bitulithic.

Little Rock, Ark.—An ordinance has been passed forming an improvement district for paving E. Markham st. from Commerce to Collins.

Clinton, Tenn.—New bids will probably be received about Oct. 1 for constructing 13 miles of macadam road. J. K. P. Wallace, chrm. co. com.

Ft. Wayne, Ind.—Resolutions have been passed to pave Buchanan and Tabor sts. with asphalt, and construct cement sidewalks in various strets.

Reading, O.—Plans and specifications are being prepared for paving Benson and Southern avs. with vitrified brick. Jos. R. Vider, vil. clk.

Knoxville, Tenn.—The property owners have been notified that all sidewalks must be of cement or vitrified brick. W. O. White, chrm. B. P. W.

Perth Amboy, N. J.—The property owners on Brighton and East aves. and State st. have petitioned for asphalt, bituminous, macadam, or brick paving.

Normal, Ill.—About 1 1-2 miles of brick paving on concrete base and 1 1-4 miles trunk sewer extension is contemplated. E. J. Metcalf, chrm. bd. local impvt.

Alexandria Bay, N. Y.—J. L. Keeler, C. E., Keeler Blk., desires to communicate with responsible contractors regarding the proposed boulevard from this city to Clayton.

Birmingham, Ala.—An ordinance has been passed to macadamize Avenue G from 8th to 15th sts., and pave the sidewalks and construct curbing and gutters. Geo. B. Ward, amyor.

Des Moines, Ia.—The aldermen voted, Aug. 8, to pave 11th and W. 13th sts., Forest Drive and Ridge road with asphalt; E. Walnut st. with brick; W. 5th st. with creosoted wood blocks.

Pittsburg, Pa.—The residents of Thomburg voted to authorize the Thomburg Land Co. to receive bids and let contracts for macadamizing and curbing the streets. Frank Thomburg, mgr.

Wheaton, Ill.—Bids will be asked for soon for 43,556 sq. yds. of macadam paving, 38,041 lin. ft. combined curb and gutter, with catch basins and brick cross walks. C. A. Prout, cy. engr.

Norfolk, Va.—The City Councils will be asked to appropriate $100,000 as the city's share in constructing the proposed Jamestown boulevard from this city to the exposition grounds.

Lincoln, Ill.—Bids will be asked soon for resurfacing 18,727 sq. yds. of brick pavement with asphalt; paving Kickapoe st. with brick; constructing 16.329 ft. of cement and concrete gutter.

Atlantic City, Ia.—Franklin and French sts. and Mt. Vernon and Hann aves. will be paved with vitrified brick and Mansion ave. with wood blocks. Ordinances will be introduced Sept. 10 for paving 15 avenues with broken stone.

CONTRACTS TO BE LET.

Elkhart, Ind.—Bids are asked until Sept. 7 for paving certain alleys. B. P. W.

Hudson, Mis.—Bids are asked until Sept. 4 for grading Vine st. Counc. com. of sts.

Sac City, Ia.—Bids are asked until Sept. 3 for constructing a cement walk. W. W. Cooper, clk.

Adrian, Minn.—Bids are asked until Sept. 15 for constructing a road. Frank Ellsworth, chm.

Escanaba, Mich.—Bids are asked until Sept. 4 for constructing macadam paving on Wells ave.

Bedford, Ind.—Bids are asked until Sept. 3 for constructing gravel roads. Walter G. Owens, co. audt.

Dixon, Ill.—Sealed bids are asked until Sept. 8 for constructing cement sidewalks. Bd. local impvts.

Petersburg, Ind.—Bids are asked until Sept. 3 for constructing gravel roads. T. W. Basinger, co. audt.

St. Paul, Minn.—Bids are asked until Sept. 4 for grading Park ave., from Wabash to University. Cy. clk.

Thornton, Ia.—Bids are asked until Sept. 6 for constructing 2,500 ft. of sidewalks. Roy Seney, recrd.

Dowagiac, Mich.—Bids are asked until Sept. 12 for 9,000 sq. yds. of brick paving. H. L. Rutter, cy. clk.

Manassas, Va.—Sealed bids are asked until Sept. 19 for macadamizing the streets. O. E. Newman, chm. const. com.

Saybrook, Conn.—Bids are asked until Sept. 1 for grading and macadamizing a road. H. G. Jones, chm. bd. selectmen.

Haddonfield, N. J.—Bids are asked until Sept. 12 for macadamizing 3 1-3 miles of public road. J. J. Alberton, co. engr.

Decatur, Ind.—Bids are asked until Sept. 3 for constructing a macadam road in Preble twp. C. D. Lewis, co. audt.

Council Bluffs, Ia.—Bids are asked until Sept. 4 for constructing gravel roads. Albert L. Winship, co. audt.
bec.

Washington, Ind.—Sealed bids are asked until Sept. 4 for constructing 1 3-4 miles of gravel road. Thos. Nugent, co. audt.

Salem, Ind.—Bids are asked until Sept. 3 for constructing 18,740 ft. of road in Brown twp. Frank E. Morris, co. audt.

Lebanon, O.—Sealed bids are asked until Sept. 8 for constructing 25,000 sq. ft. of cement sidewalks. M. E. Gustin, vil. clk.

Beloit, Wis.—Bids are asked until Sept. 1 for paving several streets with vitrified brick. R. D. Treadway, chm. B. P. W.

Atlantic, Ia.—Bids are asked until Sept. 17 for constructing brick, stone or cement sidewalks. T. E. Nichols, cy. clk.

Mankato, Minn.—Bids are asked until Sept. 15 for grading a road 1 mile west of Adrian. Frank Ellsworth, chm. bd. supvrs.

Terre Haute, Ind.—Bids are asked until Sept. 8 for constructing Gross road in Riley twp. Jerome W. Denelire, co. audt.

Rockville, Ind.—Sealed bids are asked until Sept. 3 for constructing certain gravel roads. T. A. Garrard, chm. co. comrs.

Elyria, O.—Sealed bids are asked until Sept. 4 for paving west approach to Erie ave. bridge, in Lorain. O. E. Haserodt, co. audt.

Newark, N. J.—Sealed bids are asked until Sept. 10 for telford paving on Horseneck and Westville roads. Thos. McGowan, dir. freeholders.

Jacksonville, Fla.—Plans are being prepared and bids will be asked about Sept. 17 for paving Tallerand ave. with vitrified brick. Cy. engr.

Columbus, Ind.—Sealed bids are asked until Sept. 3 for constructing more than 1 mile of road in Rockcreek twp. Wm. O. Clark, chm. co. comrs.

New Orleans, La.—Sealed bids are asked until Sept. 4 for paving Valence st., from Water to Freret sts., with asphalt. F. White, compt. ad. int.

Crown Point, Ind.—Sealed bids are asked until Sept. 4 for constructing gravel roads in Center and Hanover twps. Samuel A. Love, chm. co. comrs.

Laporte, Ind.—Bids are asked until Sept. 1 for constructing one-eighth mile of macadamized road in New Durham twp. Henry C. Kruyer, chm. co. comrs.

Winchester, Ind.—Sealed bids are asked until Sept. 11 for grading and paving with crushed stone certain public highways. John H. Boltz, co. audt.

Washington, D. C.—Bids are asked until Sept. 7 for grading and improving Connecticut ave. west of Rock Creek. H. B. F. MacFarland, chm. dist. comrs.

Waycross, Ga.—Bids are asked until Sept. 22 for constructing 16,750 sq. yds. of brick paving and 6,000 lin. ft. stone curbing. A. M. Knight, mayor.

Vicksburg, Miss.—Bids are asked until Sept. 3 for paving and sewering Washington st. from Glass Bayou bridge to Harris st. B. W. Griffith, mayor.

Neenah, Wis.—Bids are asked until 7:30 p. m., Sept. 1, for paving N. Commercial st. with vitrified paving block. J. P. Keating. cy. clk.

Plattsburg Barracks, N. Y.—Bids are asked until Sept. 6 for constructing granolithic sidewalks at this post. Capt. Edw. G. Hartman, Fifth Inf. Q. M.

Washington, D. C.—Sealed bids are asked until Sept. 4 for furnishing asphalt paving blocks at the navy yard here. H. T. B. Harris, paym. gnl.

Delaware City, Del.—Bids are asked until Sept. 12 for constructing extension of granolithic sidewalks at Fort De Pont. Capt. Louis F. Garrard, Jr., Q. M.

Harrisburg, Pa.—Sealed bids are asked until Sept. 3 for constructing 10,758 ft. of road in Coal twp., Northumberland co. Joseph W. Hunter, State highway comr.

Washington, D. C.—Bids are asked until Sept. 5 for constructing paving, furnishing and setting curb, etc., on approaches to highway bridge across Potomac river. Spencer Cosby, capt. engrs.

St. Paul, Minn.—Bids are asked until Sept. 4 for constructing a new sidewalk at the postoffice, court house and custom house here. James Knox Taylor, suprv. arch., Washington, D. C.

Chickasha, I. T.—Sealed bids are asked until Sept. 13 for paving 6 blocks of Chickasha ave., approximately 18,803 sq. yds. B. B. Bridges, chm. impvt. bd.; W. C. Burke, cy. engr.

Cohoes, N. Y.—Bids are asked until Sept. 4 for paving Church st. with brick or block, block asphalt, and creo-resinate wood and curbing. Wm. J. Elliott, cy. clk.; Chas. H. Van Auken, c.y engr.

Independence, Kas.—Bids are asked until Sept. 4 for 16,751 sq. yds. of brick paving; 4,622 lin. ft. concrete curb and gutter combined; 8,500 cu. yds. excavation. T. N. Sickles, cy. clk.

Babylon, N. Y.—Bids are asked until Sept. 4 for macadamizing, grading, curbing, guttering and otherwise improving Deer Park and Railroad aves., Main st. and Fire Island ave. LeRoy M. Young, vil. clk.

Bridgeport, Conn.—Bids are asked until Sept. 1 for 7,426 sq. yds. of brick paving on Washington st.; bids will be received separately for furnishing materials and for laying same. W. H. R. DuBois, chm. com. on sts. and sidewalks.

Great Falls, Mont.—Bids are asked until Sept. 20 for constructing 30,000 sq. ft. of concrete walks in residence districts, 20,000 sq. ft. in business districts, 2,000 sq. ft. over vaults not more than 10 ft. wide, and 10,000 over crossings; 5,000 lbs. extra steel construction and other work. W. P. Wren, cy. clk.

CONTRACTS AWARDED.

Troy, N. Y.—The contract for paving Larch ave. was awarded to John Flynn, Jr.

Kokomo, Ind.—The contract for macadamizing Delphos st. was awarded to J. H. Watson.

Argenta, Ark.—James Mahoney was awarded the contract for paving Main st. for $11,882.

Red Lodge, Mont.—The contract for constructing concrete walks was awarded to G. H. Nash.

Houston, Tex.—A. T. Lucas was awarded the contract, Aug. 15, for paving Main st. with brick.

Meadville, Pa.—The contract for paving Park ave. was awarded to Geo. J. Vetter. for $39,000.

Monson, Man.—The contract for building concrete walks was awarded to B. F. Dotney of Chicago.

Newport, Ky.—F. L. McLane & Sons were awarded the contract for improving 11th st., for $7,940.

Tulsa, I. T.—The contract for paving five blocks was awarded to W. A. Stuckey of Coffeyville, Kas.

Louisa, Va.—The contract for granolithic paving was awarded to James F. Bradley & Co., of Richmond, Va.

Hamilton, O.—The Andrews Asphalt Paving Co. was awarded the contract for paving Dayton st., for $35,681.

Bluffton, O.—A paving contract was awarded to A. J. Bogart & Co., of Columbus Grove, O., for $50,000.

Little Rock, Ark.—The contract for paving Main st. with macadam was awarded to James Maloney for $11,882.

Schenectady, N. Y.—The Union Paving Co. was awarded the contract for paving Haugh ave. with asphalt.

Butte, Mont.—The contract for constructing a new road down Deep Creek was awarded to Chas. Isaacs, for $4,500.

Franklin, Pa.—The contract for paving Franklin ave. with brick and curbing was awarded to Frank T. Sutley. city.

Baltimore, Md.—The United Railways Co. has awarded the contract for repairs to Charles st. extended to Hook & Ford.

Piqua, O.—The contract for 2,130 sq. yds. of brick paving was awarded to R. D. Colburn, of West Milton, O., for $3,986.

Slayton, Minn.—P. F. Connelly, of Sioux Falls, S. D., was awarded the contract for 10.000 lin. ft. of cement walk here.

New Ulm, Minn.—Reiser & Langmack secured the contract for building a cement walk on 1st South st., at $1.20 a sq. ft.

Ottawa, Ont.—The Warren Bituminous Paving Co., of Toronto, was awarded the contract for paving Elgin st. for $65,892.

Chillicothe, Ill.—The contract for paving one block between Walnut and Pine sts., was awarded to A. D. Thompson, of Peoria.

Oklahoma City, Okla.—The Barber Asphalt Paving Co. was awarded the contract for paving Hudson ave. with asphalt for $10.989.

Dallas, Tex.—The contract for paving Akard st. with bitulithic was awarded. Aug. 6, to the Texas Bitulithic Co., for $6,000.

Wilmington, Del.—The contract for constructing cement walks in Sheridan and awarded to Stewart & Donahue, for $11,300.

Miles City, Mont.—The contract for constructing cement crossings was awarded to Chris Arneberg at 22 1-2 cts. a sq. ft.

Janesville, Wis.—The contract for constructing cement walks in Sheridan and Fountain Parks was awarded to Lang & Bliss.

Tacoma, Wash.—The contract for paving the triangular district was awarded to the Independent Asphalt Paving Co. for $56,473.

East Chicago, Ill.—The contract for paving Fir and 137th sts. was awarded to Ahlborn & Co.. of Hammond, Ind.. for $37,000.

Clarksburg, W. Va.—Gladden, Alexander & Stoyle have been awarded the contract for 25,000 sq. yds. of cement concrete paving.

Boston, Mass.—The Barber and Trinidad Asphalt Companies were awarded the contract for resurfacing Columbus ave., Roxbury Crossing.

Petersburg, Va.—Perkinson & Finn have been awarded the contract for paving Old st. with rubblestone, at $1.09 a sq. yd.

Petersburg, Ill.—The contract for 1 mile of brick street paving was awarded to A. L. Frank, of Jacksonville, Ill., for $39,600.

Green Bay, Wis.—The lowest bid submitted for macadamizing E. and W. Mason st. was that of John Stiffler, of Marinette, who bid $11,450.

Norwalk, O.—The contract for paving two sections of Benedict ave. and E. Main st. was awarded to W. S. Hadley, of Canton. O., for $20,000.

Trenton, N. J.—The contract for constructing a concrete and cement roadway on the Monmouth st. bridge was awarded to Wm. F. McGovern.

Boise, Ida.—The contract for paving 10th, 9th, 7th, Jefferson, Bannock. Grove and Front sts. was awarded to the Warren Construction Co.

Pontiac, Ill.—The contract for constructing 50 blocks of concrete walks was awarded to A. D. Thompson, of Peoria, at 12 8-9 cts. a sq. ft.

New Britain, Conn.—The contract for macadamizing a number of streets was awarded to MacDonald & Hennessey, of Middletown. at $2.39 a lin. ft.

Salt Lake, Utah—The contract for all concrete gutter and curbing required during the season was awarded Aug. 14 to L. Birch, for $27,131.24.

Decatur, Ill.—The Granite Bituminous Paving Co. was awarded the contract for paving N. Union and Edward sts. for $42,800, and $23,624, respectively.

Fremont, O.—The contract for paving Arch, S. Front, Tiffin and McPherson sts. was awarded. Aug. 8, to Geo. Kinney and the Modern Construction Co.

Norfolk, Va. — The Sands-Lawson Key Co., Norfolk, was awarded the contract for constructing granolithic sidewalks for the Jamestown Exposition Co.

Ashtabula, O.—The contract for paving S. Main st. with asphalt block on concrete base was awarded to Pullman & Starkweather. for $24,491.97.

Paoli, Ind.—The contract for constructing Lost River and Bona gravel roads in North East twps., was awarded to Elwood Johnson, of Orleans, for $3,094.

Dayton, Ky.—The contract for constructing combined curb and gutters on 4th st., between Boone and Renton, was awarded to Walters Bros., at 55 cts. a lin. ft.

Elm Grove, W. Va.—The contract for paving National road was awarded to Geo. W. Lemmon at 97 cts. a sq. yd.; curbing, Ft. Henry Construction Co.. 40 cts. a lin. ft.

Troy, N. Y.—E. H. McKenna was awarded the contract for paving 6th ave. from Jacob to Hoosick sts., and Jacob st., from 5th to 6th, with Resse-Hammond brick.

Chattanooga, Tenn.—The Barber Asphalt Paving Co. submitted the lowest bid, Aug. 27, for resurfacing McCallie ave. and A. and Columbia sts. with asphalt, at $1.34 a sq. yd.

Lake Charles, Ia.—The contract for paving Ryan, Pujo and Broad sts. has been transferred to James Pringle & Sons. of Kansas City, to the Missouri Construction Co.

Hamilton, O.—W. N. Hamilton, of this city, has been awarded contracts for asphalt paving and Bridges Sons' Co., of Wabash, Ind., for vitrified brick paving on various streets.

St. Louis, Mo.—The Hill & Gaynord Construction Co. was awarded contracts, Aug. 11, for paving 24th, 11th and 31st sts.. and St. Louis ave. Walter Coonan, 15th st.; McCabe & Son, 15th st.

Springfield, Ill.—The contract for paving Monroe st. with asphalt was awarded to the Barber Asphalt Paving Co. at 82 1-2 cts. a sq. yd., and 53 cts. a lin. ft. for combined curb and gutter.

Muncie, Ind.—Richard McGanley was awarded the contract for constructing cement curbing and gutters on Kirby ave. and Chas. Russey the contract for macadamizing 8th st., at $1.65 a lin. ft.

Toronto, Ont.—An additional contract for 8,202 sq. yds. of bitulithic has been awarded to the Warren Bituminous Paving Company of Toronto.

Walla Walla, Wash.—Warren Construction Co., of Portland, Ore., has received an additional contract for 2.700 sq. yds. of bitulithic.

St. Catharines, Ont., has contracted with the Warren Bituminous Paving Co., of Toronto, Ont., for 3,800 sq. yds. of bitulithic.

Anniston, Ga.—A contract for 10,000 sq. yds. of bitulithic has been awarded to the Southern Bitulithic Co., of Nashville, Tenn.

Iowa City, Ia.—William Horrabin has contracted to lay 1.987 additional sq. yds. of bitulithic.

New Brunswick, N. J., has contracted with the Standard Bitulithic Co., of New York, for 3,500 sq. yds. of bitulithic.

Indianapolis, Ind.—A contract for 12,000 sq. yds. of bitulithic has been made with the Western Construction Co., of Lafayette, Ind.

Donaldson, La.—The Southern Bitulithic Co., of Nashville. Tenn., has received a contract for 20,000 sq. yds. of bitulithic.

Regina, Sask., Can.—A contract for 8,815 sq. yds. of bitulithic has been made with the Warren Bituminous Paving Co., of Toronto, Ont.

Waterbury, Ct.—An additional contract for 12,000 sq. yds. of bitulithic has been awarded to the Warren Brothers Co., of Boston, Mass.

Manistee. Mich.—A contract for 3,250 sq. yds. of bitulithic has been awarded to the Central Bitulithic Co., of Detroit, Mich.

Toronto, Ont.—The Warren Bituminous Paving Co., of Toronto, Ont., has been awarded a contract for 3,045 sq. yds. of bitulithic.

Birmingham, Ala.—Additional contracts aggregating 8,970 sq. yds. of bithulithic have been awarded the Southern Bitulithic Co., of Nashville, Tenn.

Chatham. Ont.—Council has awarded the Warren Bituminous Paving Co., of Toronto, Ont., an additional contract for 3,552 sq. yds. of bitulithic.

Philadelphia, Pa.—The Standard Bitulithic Co., of New York, will construct 2,339 sq. yds. of bitulithic at the U. S. Army Depot.

Jamestown, N. Y.—The Board of Public Works has awarded the Warren Brothers Co., of Boston, a contract for 15,421 sq. yds. of bitulithic.

Walla Walla, Wash.—Additional contracts aggregating 48,592 sq. yds. of bitulithic, have been awarded the Warren Construction Company, of Portland, Ore.

Amherst, N. S.—A contract for 9,000 sq. yds. of bitulithic at $2.75 per sq. yd.. has been awarded the Warren Bituminous Paving Co., of Toronto. Ont.

Detroit, Mich.—The Central Bitulithic Co., of Detroit, Mich., has been awarded a contract for 19,986 sq. yds. of Acme asphalt.

Waterbury, Ct.—The City Council of Waterbury, Ct., has awarded the Warren Brothers Co., of Boston. Mass., an additional contract for 3,400 sq. yds. of bitulithic.

Portland, Ore.—The Warren Construction Co., of Portland, Ore., has been awarded an additional contract for 6,191 sq. yds. of bitulithic.

Tamaqua, Pa.—The Standard Bitulithic Co., of New York, has been awarded a contract for 13,000 sq. yds. of bitulithic.

Kirksville. Mo.—A contract for 11,500 sq. yd. Alpheus Cruzan was awarded the Granite Bituminous Paving Co.

North Platte, Neb.—The contract for constructing sidewalks and culverts was awarded to the North Platte Cement Co. at 20 cts. a sq. ft. for sidewalks, and 22 1-2 cts. a sq. ft. for culverts.

Napoleon, O.—Contracts for constructing county roads were awarded to C. W. Ryan, of Whitehouse, O.; R. Conway, of ...dgeville Corners; Frank Burr, Malinta, O.; Cody & Hennessey, of Malinta.

New York City—The U. S. Wood Preserving Co., 29 Broadway, was awarded the contract for paving Southern Boulevard. from Boston road to St. John's University grounds, with wood block, for $173,170.

Evanston. Ill.—John A. McGarry & Co., secured the contract for paving an alley with brick at $1.74 a sq. yd., and M. Foley the contract for paving Milburn st. with granite top macadam for $2,209.

Rochester, Minn.—The contract for paving Quinbro st. with brick was awarded, Aug. 21, to Fielding & Shepley, of St. Paul, at $1.95 a sq. yd. for paving, and 62 cts. a lin. ft. for cement gutters and curbing.

Milwaukee, Wis.—The contract for paving Grand ave. from 11th to 13th st., was awarded to the Barber Asphalt Paving Co., at $1.45 a sq. yd.; brick paving on Prairie st., Wm. Gutknecht, $1.76 a sq. yd.

Chicago, Ill.—The Garden City Paving and Port Co. was awarded the contract for paving Marshall Boulevard, Aug. 15, for $79,000. The Knickerbocker Roofing and Paving Co. was awarded the contract for concrete sidewalks, for $26,600.

Youngstown. O.—Paving contracts were awarded Aug. 7 as follows: Miller & Caldwell, Burke st., brick, $7,409.60; Barber Asphalt Paving Co., Michigan ave., asphalt, $4,174; Pennsylvania ave., asphalt, $4,968.50; Elm st., asphalt, $13,349.

Danville, Ill.—The Moellering Construction Co., of Ft. Wayne, Ind., was awarded the contract for paving Buchanan st. at $1.33, and South st. at $1.31 a sq. yd. Alpheus Cruzan was awarded the contract for curbing Commercial st. at 34 cts. a lin. ft.

Rochester, N. Y.—Thos. Holahan was awarded the contract for paving South ave. with Medina block and constructing a sewer for $84,746.50. Whitmore, Rauber & Vicinus secured the contract for asphalt paving and a sewer on St. Paul st. for $39,885.

Detroit, Mich.—Paving contracts have been awarded as follows: 1st st., Central Bitulithic Co., $10,500; Ferry st., cedar blocks, Jas. Hanley, $18.000; Agney st., cedar blocks, T. E. Curry, $6,400; Trombley st., brick, W. W. Hatch & Sons, $9,400; Howard st., brick, Lennane Bros., $11.000.

Muncie, Ind.—The Barber Asphalt Paving Co. has been awarded contracts for resurfacing 16 blocks of streets with asphalt, as follows: asphalt surfacing, $1.26 a sq. yd.; brick paving along car tracks, $1.42; cement gutter, $1.10 a lin. ft.; concrete work, 85 cts.; repair work, $3.00 a sq. yd.; curb stone, 45 cts, a lin. ft.

St. Louis, Mo.—Contracts for paving 28 streets were awarded Aug. 14 to the Parker Washington Co., Trinidad Asphalt Mfg. Co., Barber Paving Co.. Wm. R. Bush Construction Co., G. Eyermann & Bro., T. E. Cavanagh, Wm. R. Bush Construction Co., Granite Bituminous Paving Co., Wm. H. Redemeyer and the Herman Construction Co.

Indianapolis, Ind.—Contracts have been awarded as follows: Cement walks in Sheldon st., A. L. Neister, 57 cts. a lin. ft. and $1.29 for cement walks and curbing; brick paving, Pratt st., Daniel Foley, 34 cts. a lin. ft.; Westrumite macadam, Capitol ave., $1.37. $1.28 and $1.43 a lin. ft., Marion County Construction Co.; cement walks and curbing, 34th st., J. Harry

Roberts, $1.29; gravel roadway and brick gutters, 32nd st., City Construction Co., 90 cts. a lin. ft.

Omaha, Neb.—The Barber Asphalt Paving Co. submitted the lowest bid, Aug. 6, for paving Farman st., at $2.22 a sq. yd. Hugh Murphy bid $2.30 . Other bids received as follows:

Thirty-fifth ave., Leavenworth to Jackson—Hugh Murphy, asphalt. $1.73; brick block, $2.02. National Construction Co., brick block, $1.80 and $1.97, the latter figure from this firm in all cases being for Purington block. C. E. Fanning, brick block, $2.08. Barber Asphalt Co., asphalt, $1.64 1-2.

Forty-first ave., Seward to Hamilton—Hugh Murphy, asphalt, $1.80; brick block, $2.02. National Construction Co., brick block, $1.80 and $1.97. C. E. Fanning, brick block, $2.08. Barber Asphalt Co., asphalt, $1.68 1-2.

Harney, Twentieth to Twenty-fourth—Hugh Murphy, asphalt, $1.68; brick block, $1.68. National Construction Co., brick block, $1.70 and $1.87. C. E. Fanning, brick block, $1.75. Barber Asphalt Co., asphalt, $1.91.

Alley between Sixteenth and Seventeenth, Howard and Jackson sts.—Hugh Murphy, stone, $3.25; brick block, $2.50. National Construction Co., brick block, $2.20 and $2.47. C. E. Fanning, brick block, $2.55. Barber Asphalt Co., asphalt, $1.97.

New York City—Paving contracts were awarded, Aug 13, as follows:

For paving with asphalt Cypress ave., in the Ridgewood section, from Gates ave. to Brooklyn line, 2,000 lin. ft.; Uvalde Asphalt Paving Co., $14,258.

Repaving with macadam Hoffman Boulevard, from North Hempstead plank road to Grand st., Newtown; Thomas F. Tuohy, $19,200. Same, Hillside ave., from Bergen ave. to Myrtle, Jamaica; Place Brothers, $56,160. Same, College Point causeway, from Myrtle ave. to 9th ave., College Point; Place Brothers, $25,000.

Grading and paving with asphalt Jamaica ave., from Steinway ave. to Newtown ave., Long Island City, Barber Asphalt Co., $3,918. Same, Sixth ave., Long Island City, from Broadway to Graham, Hastings Paving Co., $6,797.50. Seventh ave., Long Island City, from Jackson to Washington, Hastings Paving Co., $7,817.50. Eighth ave., Long Island City, from Flushing ave. to Foster ave., Hastings Paving Co., $10,051.50. Sixteenth ave., Long Island City, from Broadway to Graham, $6,825.50; Thirteenth ave., Long Island City, from Broadway to Jamaica ave., Barber Asphalt Co., $6,691. Eleventh ave., from Broadway to Newtown road, Long Island City, Hastings Paving Co., $11,543.

For regulating, grading and laying sidewalks on Graham ave., Long Island City, from Steinway ave. to Second ave., Long Island Construction and Supply Co., $16,071. First ave., Long Island City, from Webster to Payntar, $12,276.50.

SEWERS.

CONTEMPLATED WORK.

Paragould, Ark.—A sewerage system is contemplated.

Shelbina, Mo.—A sewerage system is proposed.

Parkersburg, Ia.—The question of building a sewerage system is being agitated.

Kenmare, N. D.—A sewerage system is contemplated.

Butler, Ind.—A sewerage system is contemplated.

Anita, Ia.—A 4-ft. brick sewer on Walnut-st. is contemplated.

Ft. Pierre, S. D.—The installation of a sewer is contemplated.

Bowbells, N. D.—Voted to issue bonds for building sewers.

Redwood Falls, Minn.—Council has ordered the construction of 6-in. sewers.

Bellevue, Ky.—The estimated cost of a sewerage system is $60,000.

Merchantville, N. J.—Voted to construct a sewerage system.

Batavia, N. Y.—May vote soon on question of constructing a sewage system.

Eatonton, Ga.—Voted to issue bonds to establish a sewerage system.

Crete, Neb.—Bonds for the proposed sewerage system have been voted.

Elkins, W. Va.—Will vote on the extension of the sewerage and water works system.

Hudson, Mich.—Voted to appropriate $6,000 for the construction of new sewers.

Cloquet, Minn.—The question of building sewers is being agitated.

Monmouth Beach, N. J.—Voted to construct a sewerage system at a cost of $65,000.

Elroy, Wis.—Bids will be asked soon for building 1 mile of sewers. J. M. Dix, cy. clk.

Oakley, O.—Bids are asked until Sept. 10 for $7,500 sewer bonds. W. E. Sellkop, clk.

Morton, Minn.—Estimates will be made of the cost of establishing a sewerage system.

Lansing, Mich.—A brick sewer in Washtenaw st. is proposed. H. A. Collar, cy. engr.

Little Rock, Ark.—Plans and specifications are being prepared for two septic tanks.

Waterloo, Ia.—The residents along Virdens creek are in favor of building a sewer.

Lockland, O.—Plans for the proposed reduction system of sewerage have been completed.

Red Deer, Man.—Voted to raise $30,000 for constructing a municipal sewerage system.

Bainbridge, Ga.—Will vote Sept. 10 on issue of bonds for building a sewerage system.

Lewiston, Mont.—The question of constructing a sewerage system is being considered.

Canton, Miss.—The issue of bonds for constructing a sewerage system is being considered.

Port Huron, Mich.—The residents on Petit, 23rd and Cedar sts. have petitioned for sewers.

Chicago, Ill.—The residents of Norwood Park are agitating the question of a sewerage system.

London, O.—Bids are asked until Sept. 4 for the purchase of $27,500 bonds. J. J. Shaffer, co. audt.

Toronto, Ont.—Plans for sewerage disposal plant will be prepared by G. R. Strahan, M. I. C. E.

Altoona, Pa.—Ordinances have been passed and bids will be asked for building a large number of sewers.

Ottumwa, Ia.—Plans have been prepared for a storm water sewer system to cost $90,000. C. R. Allen, cy. engr.

Athens, O.—Bids are asked until Sept. 3 for the purchase of $1,500 sewer bonds. W. B. Golden, vil. clk.

Paris, Tex.—The property-owners are

considering the question of constructing a sewer on the East Side.

Massillon, O.—An ordinance has been passed to build a sewer in Jarvis ave. and Green st. Chas. L. Frantz, mayor.

Birmingham, Ala.—An ordinance has been passed providing for the construction of sewers. Geo. B. Ward, mayor.

Syracuse, N. Y.—Plans are being prepared for constructing a sewerage system in Elmwood, at a cost of $50,000.

Canton, Ill.—An ordinance has been passed for building 1,600 ft. of sewer on Avenue D. R. H. Bond, cy. engr.

Kendallville, Ind.—City Council has decided to construct sewers in the central and eastern parts of the city.

Norwood, O.—Bids are asked until Sept. 7 for the purchase of $20,000 sewer bonds. W. E. Wichgar. cy. audt.

Dundee, Ill.—The residents of West Dundee will probably vote on the question of installing a sewerage system.

Newport, Ark.—This city contemplates the construction of a sewerage system and will want estimates from engineers and contractors.

Baltimore, Md.—Plans and specifications for constructing storm water sewers have been completed. Estimated cost, $197,000.

Alliance, O.—Ordinances have been passed providing for the construction of sewers in certain alleys. John L. McConnell, mayor.

Douglas, Ariz.—Bids are asked until Sept. 17 for $75,000 5 per cent. sewer bonds. T. A. Daley, cy. clk.

East Las Vegas, N. M.—Special.—P. F. Nolan advises us that he is in the market for materials for tile and concrete sewers.

Washington, Pa.—Plans will probably be completed by October for the proposed sewage disposal plant. O. K. Taylor. Jr., cy. engr.

Hallock, Minn.—Plans and specifications are being prepared for about 2,000 lin. ft. of sewers and septic tanks. Wm. Kelso, mayor.

Holly, Mich.—After receiving bids twice for constructing lateral sewers on Washington ave. and S. Saginaw st., Council will probably build the sewers.

New York City—Plans have been prepared for a sewerage system for Richmond Hill and Morris Park. by Joseph De Bragga, supt. of sewers for Queen's boro.

Louisville, Ky.—The topographical map of the proposed new sewerage system has been completed, and the engineers will proceed with designing the system.

Norman. O. T.—City Council has let the contract for preparing plans and specifications for a new sewerage system, and the question will be voted on soon.

Stockton, Cal.—Voted to issue $30,000 bonds for extensions of rain water sewers and $10,000 for extension of the sanitary sewer system. R. C. Tumelty, cy. engr.

Alton. Ill.—Preliminary plans are being made by E. M. Long, cy. engr., for a rainforced concrete sewer for the East End to cost $100,000 and for the West End to cost $35,000.

Indianapolis, Ind.—The property-owners of Brightwood are in favor of annexing the territory between Brightwood and Fall Creek, in order to build a sewer through that territory.

Sterling, Ill.—A petition is being circulated asking for the construction of a sewerage system to drain Summit Place and Martin Brothers' additions to the city. John D. Arey, cy. engr.

Fairbury, Neb.—Special.—W. W. Watson, cy. engr., says City Council has granted petitions for 6 new sanitary sewer districts and instructed the city engineer to prepare plans and estimates for same. Bids will be received as soon as necessary preliminaries are arranged.

Belleville. N. J.—The township committee received a communication. Aug. 21, from Morris R. Sherrard, ch. engr. of public works of Newark, suggesting that the officials of this municipality join with that city in the establishment of a sewer system that would drain parts of Newark, East Orange, Belleville and Bloomfield.

CONTRACTS TO BE LET.

New Ulm, Minn.—Bids are asked until Sept. 4 for building a sewer on Center st.

Green Bay, Wis.—Bids are asked until Sept. 3 for building sewers. Com. on sewers.

Oshkosh, Wis.—Bids are asked until Sept. 15 for building a sewer in High st. B. P. W.

Grand Forks, N. D.—Bids are asked until Sept. 3 for building lateral sewers. W. V. O'Connor, cy. audt.

Plainfield, N. J.—Bids are asked until Sept. 4 for building sanitary sewers. Andrew J. Gaveytt. cy. surv.

St. Marys, O.—Bids are asked until Sept. 5 for constructing a sanitary sewerage system. H. W. Stearns. clk.

Ft. Hunt, Va.—Bids are asked until Sept. 6 for the drainage of the parade grounds here. Constr. Q. M.

Brewster, Minn.—Bids are asked until Sept. 3 for constructing 7,755 ft. of drains. Otto Knuth, vil. recdr.

Wahpeton, N. D.—Bids are asked until Sept. 4 for laying 50 ft. of 12-in. sewer tile. Wm. H. Purdon, cy. audt.

Vicksburg, Miss.—Bids are asked until Sept. 3 for building a sewer on Washington st. H. J. Trowbridge, cy. clk.

Junction City, Kas.—Sealed bids are asked until Sept. 4 for constructing a sewerage system. T. W. Dorn, cy. clk.

Dowagiac, Mich.—Bids are asked until Sept. 12 for building sewers in sundry streets. H. L. Ruter, cy. clk.

Denton. Md.—Bids are asked until Sept. 12 for constructing a sewerage system. Wm. D. Uhler, engr.; C. Leslie Wells, clk.

Oshkosh, Wis.—Bids are asked until Sept. 1 for building sewers in Knapp and Light sts. Geo. H. Randall, cy. engr.

Carrick, Pa.—Bids are asked until Sept. 5 for constructing 26 miles of 24-in. sew-

Glenview, Ky.—The Glenview Water ers. Wm. McClurg Donley, boro. engr.

Jamestown, N. D.—Bids are asked until Sept. 3 for constructing a septic tank and contact filter. John G. Bensch, cy. audt.

South Omaha, Neb.—Bids are asked until Sept. 4 for constructing the South Omaha relief main sewer. Dan B. Butler, cy. clk.

Marcus Hook, Pa.—Bids are asked until Sept. 3 for building a 3-ft. brick sewer on Market st. H. C. Valentine. chm. on sewers.

Mountain Lake, Minn.—Sealed bids are asked until Sept. 24 for constructing a sewerage system. J. H. Dickman. vil. recdr.

Marietta, O.—Sealed bids are asked until Sept. 6 for constructing sewers on a large number of streets. A. F. Cole, cy. engr.

Morrisonville, Ill.—Bids are asked until Sept. 6 for furnishing, hauling and distributing drain tile. Chance Wells, town clk.

Nappanee, Ind.—Sealed bids are asked

until Sept. 14 for constructing sewer No. 4 of the north sewer system. John W. Brown, town clk.

Chemawa, Ore.—Bids are asked until Sept. 13 for constructing a sewerage system here. C. F. Larrabee, act. comr. Indian affairs, Washington, D. C.

Normal, Ill.—Bids are asked until Sept. 3 for constructing vitrified pipe sewers on a number of streets. J. G. Melluish, cons. engr., Bloomington, Ill.

Covington, Tenn.—Bids are asked until Sept. 11 for building a sewerage system. consisting of 5 miles of pipe sewers and 2 septic tanks. Sherrod Smith, mayor.

St. Charles, Mo.—Bids are asked until Sept. 7 for constructing a sewerage system and for furnishing labor and materials for pumping plants for the system. C. H. Kansteiner, cy. clk.

Omaha, Neb.—Bids are asked until Sept. 4 for construoting a sewer in dist. 327; 3.700 ft. of brick or concrete sewer, 7 1-2 ft. in diameter, and 80 ft. 7 ft. in diameter. Dan B. Butler, cy. clk.

Manila, P. I.—Sealed bids are asked until Sept. 12 for furnishing and delivering at ship's side in this city sewer gates and sluice gates for use in the proposed sewerage system. J. F. Case, ch. engr.

Helena, Mont.—Bids are asked until Sept. 3 for constructing a storm sewer in dist. No. 17, requiring 200,000 paving brick, 800,000 ordinary brick, laying 1,000,000 brick. including mortar, etc. F. J. Sterling, cy. clk.

Utica, N. Y.—Bids are asked until Sept. 7 for constructing a storm water sewer drain of vitrified pipe and brick in Oneida st., and a 30-in. storm water drain of c. i. pipe and vitrified pipe in Noyes st. Paul Schultz, cy. engr.

Aberdeen, S. D.—Bids are asked until Sept. 3 for constructing a sewage pump house, a 6,000,000 gal. septic tank of reinforced concrete construction; a 55 h. p. gas producer and gas engine, a 55 h. p. steam engine and boiler complete, one 10-in. centrifugal sewer pump. with counter shafting, pulleys, etc. F. W. Raymond, cy. audt.

CONTRACTS AWARDED.

Medford, Wis.—H. A. Giles was awarded the contract for building sewers for $5,820.

Morris, Minn.—The contract for constructing a sewerage system was awarded to Tanner Bros., of St. Paul, for $23,000.

Bemidji, Minn.—The contract for constructing sewerage system was awarded to Bosworth Bros., of Ada, for $5.145.

Springfield, Mass.—D. F. Dorey & Co., of Somerville, was awarded the contract for constructing the Union st. sewer.

Des Moines, Ia.—The King-Lambert Co. was awarded a contract for constructing the Northwest sewer system for $21,500.

Weatherford, Tex.—The contract for constructing a sewerage system was awarded to Hamilton Bros., of Ft. Worth, for $20,000.

Lewiston, Ida.—The contract for constructing sewerage was awarded to Jas. A. R. Clark. of Spokane, Wash., for $105,-062.

Reading, Pa.—The contract for constructing the northwestern intercepting sewer was awarded to Joseph P. O'Reilly, for $28,027.34.

Duluth, Minn.—The contract for constructing storm sewers on Pleasant st. was awarded to John F. & Jeremiah F. Augar, for $10,322.

Seneca Falls, N. Y.—Contracts for constructing sewers were awarded to the Wilkesbarre Construction Co., of Wilkesbarre, Pa., for $55,000.

Clarence, I. T.—The contract for constructing storm sewers was awarded. Aug. 9, to the N. S. Sherman Machine Co., of Oklahoma City. for $17,500.

Westfield, Mass.—The contract for building section 12 of storm water sewers was awarded to Daniel A. Rorcy, of West Somerville, for $6,255.

Cincinnati, O.—The contract for reconstructing the Linden st. sewer, between 8th and 9th sts., was awarded to Joseph Collopy, of Newport, for $3.580.

Kansas City, Kas.—The contract for constructing the Oak ave. sewer in District No. 4 was awarded to the Parker-Washington Co., of Kansas City, Mo., for $16,000.

Birmingham, Ala.—Sullivan & Long, Bessemer, Ala., and Nashville, Tenn.. have been awarded the contract for building a sewerage system in Woodlawn, for $30,-000.

Escanaba, Mich. — Special.—D. A. Brotherton, cy. engr., says the contract for constructing 2,435 ft. of 8-in. sewer, 9 manholes and 6 lamp holes, was awarded, Aug. 8. to John McLaughlin, of this city, for $2,731.89.

St. Louis, Mo.—Sewer contracts were awarded, Aug. 17, as follows: 9th st., No. 3, Meyers Construction Co., $49,-522.90; Harlem Creek sewer No. 2, McIntyre & Teese Construction Co., $46.-489.18; 13th st. sewer No. 6, Meyers Construction Co., $14,471.10; Ferry st. sewer No. 28, Prendergast Contracting Co., $417.18.

Sayre, Pa.—Bids for constructing 6,900 ft. of 18 to 24-in. vitrified pipe sewers were submited Aug. 15 as follows: D. M. Rosser, Kingston, Pa., $21,270; Walker. Connelly & Shay, Elmira, N. Y., $22,786; Wilkesbarre Construction Co., Wilkesbarre, Pa., $24,574; John J. Tyne, Binghamton, N. Y., $27,061. and Berghaus & Moffitt, Harrisburg, $27.593. Engineers' estimate, $19,368.

Milwaukee, Wis.—Sewer contracts have been awarded as follows: Thirteenth st. from Fond du Lac ave. to Burleigh st., 1,693 ft. of brick sewer at $22.10 and 315 feet of pipe sewer at $2.20, to Meyers & West; S. Bay st. from Russell ave. to Pryor ave., 958 ft. of brick sewer at $4.24 and 40 ft. of pipe at $1.40, to T. Szukalski; pipe sewer in Beulah ave. from Russell ave. to Pryor ave., to G. E. Zimmermann, at $1.41; pipe sewer in 16th ave. from Grant st. to Forest Home ave.. to G. E. Zimmermann, at $1.32; pipe sewer in Poplar and 12th st., 741 ft., to G. E. Zimmermann, at $1.79; brick sewer in 3d and Russell aves., 1,287 ft.. to T. Szukalski, at $15.

WATER WORKS.

Baton Rouge, La.—City Council completed arrangements, Aug. 8, for the purchase of the plant of the Water Works Co. by arbitration, by the acceptance of the engineer appointed by the Water Works Co., and by the appointment of Griffin O'Neil. of Dallas, Tex., to represent the city. John Alvord, of Chicago, is the company's engineer, and these two are to select the third engineer, if they cannot agree upon the value of the plant, and their appraisement is to be taken as final, so far as the Water Works Co. is concerned.

CONTEMPLATED WORK.

Salem, Ind.—The water supply is reported as decreasing very rapidly.

Evanston, Ill.—Plans will be submitted, Sept. 11, for the new water works intake.

Cameron, Mo.—Voted to issue bonds for extending the water works system.

Sulphur, I. T.—No engineer has been selected yet for the proposed water works system.

Lynn, Mass.—Plans for improving and enlarging the water supply are being considered.

Bemidji, Minn.—Council voted, Aug. 13, to construct 10 more blocks of water mains.

Paragould, Ark.—This city is considering the matter of repairing the water works system.

Providence, R. I.—A new 10,000,000 gallon engine has been recommended for Hope station.

Brunswick, Mo.—The installation of a filter plant is proposed. B. M. Strub interested.

Wauseon, O.—Plans have been prepared for a water works system. E. H. Harrison, chm. B. P. S.

Red Wing, Minn.—The construction of a sand filter system is contemplated. A. E. Rhame, cy. engr.

Indianapolis, Ind.—The bd. of wks. has decided to drive some of the city wells to a greater depth.

Lumberton, N. C.—This town is considering the issue of bonds for extending the waterworks system.

Charlottesville, Va.—This city has authorized a bond issue of $135,000 for improving the water system.

Morrilton, Ark.—The Morrilton W. W. Co. has been incorporated to erect and operate a waterworks plant.

Lakewood, O.—Bids are asked until Sept. 5 for the purchase of $5,000 water main bonds. B. M. Cook, clk.

Franklin, W. Va.—Surveys and estimates for a waterworks system will be made by W. S. Fallis, of Harrisonburg, Va.

Richfield, Utah—Plans have been submitted for constructing 2 dams for the new reservoir along the Sevier river.

Bryan, Tex.—The extension of the water and the enlargement of the pumping capacity of the waterworks is proposed.

Bovey, Minn.—Bids are asked until Sept. 3 for the sale of $10,000 waterworks bonds. Frank Provinske, prest. vil. coun.

Seattle, Wash.—About 44 miles of new mains for the new water distribution system will be necessary, according to press reports.

Trenton, Mo.—About 10,000 ft. of 10 and 6-in. water pipe and a dam 300x50 ft. for the storage reservoir will be constructed.

Auburn, Wash.—A waterworks system, the supply to be furnished from artesian wells, and a concrete tank are contemplated.

Canon City, Colo.—A plan for a gravity water system has been recommended by Hiram Phillips, C. E., of St. Louis, Mo.

West Branch, Ia.—E. G. Eves has been appointed chairman of a committee to secure an engineer to make estimates for waterworks.

The construction of waterworks systems is contemplated at the following places: Kamiah, Idaho; West Branch, Ia.; Jefferson, O.; Bovey, Minn.; Cloquet, Minn.; Cle Elum, Wash.; Shelbina, Mo.; Alma Center, Wis.; Grenada, Minn.; Kelliher, Minn.; Key West, Fla.; Harmon, Ill.; Bradford, Ont.; Victoria, B. C.; Villard, Minn.; Fountain, Minn.; Gothenburg, Neb.; Salem, Ill.; Iron River, Mich.; Morrow, O.

Batavia, Ill.—The water and light com. has been directed to secure specifications and prices for a new set of four boilers for the waterworks.

The question of issuing waterworks bonds will be voted on at the following places: Avoca, Ia., Sept. 1; Greenfield, Ia., Sept. 10; Scranton, Ia., Sept. 10; Selkirk, Man.

Seattle, Wash.—The question of issuing bonds for the extension and enlargement of the Cedar River water system will be voted on Sept. 12.

Evansville, Ind.—The city clerk is reported as having been directed to secure information on filtration plants in other cities with a view to establishing one here.

Virginia Beach, Va.—The town council has secured the services of George W. Fuller, of New York city, to investigate the most available source of water supply for this place.

Hastings, Minn.—City council has approved the action of the water commissioners in selecting H. H. Harrison and L. W. Clark, of Stillwater, to make plans for a waterworks system.

Oakland, Cal.—This city is considering two plans for installing a salt water pumping plant to supply water for the protection of the city against fire and to establish a distributing system for this salt water.

The question of issuing waterworks bonds has been favorably voted on at the following places: Moorhead, Ia.; Osyka, Miss.; Alma Center, Wis.; Bowbells, N. D.; Coalgate, I. T.; Poplarville, Miss.; Decatur, Ga.; Fredericksburg, O.

CONTRACTS TO BE LET.

Perth Amboy, N. J.—Bids are asked until Sept. 5 for retubing condenser of Snow pump at Runyon, N. J., the contractor to furnish 600 5-8-in. condenser tubes of proper length, together with ferrules, etc. J. G. Burns, supt. bd. water comrs.

Asbury, N. J.—Bids are asked until Sept. 10 for an internal furnace boiler for the water department.

Jacksonville, Fla.—Bids are asked until Sept. 4 for furnishing and erecting an engine. Trustees W. W.

Malta, O.—Sealed bids are asked until Sept. 4 for constructing a waterworks system. Corporation clk.

Mountain Lake, Minn.—Bids are asked until Sept. 4 for extending a water main. David Ewert, prest. coun.

Winnipeg, Man.—Bids are asked until Sept. 5 for furnishing 2,000 ½-in. water meters. C. J. Brown, cy. clk.

Manassas, Va.—Sealed bids are asked until Sept. 19 for constructing waterworks. O. E. Newman, chmn. constr. com.

Neosho, Mo.—Sealed bids are asked until Sept. 20 for improvements and extensions to the water system. J. W. Hanson, cy. clk.

Middletown, O.—Bids are asked until Sept. 5 for laying 8,000 ft. of 4 and 6-in. water pipe. N. G. Oglesby, clk. B. P. S.

Clinton, Mo.—Sealed bids are asked until Sept. 18 for constructing a waterworks system. G. V. Berry, cy. clk.

Tinley Park, Ill.—Sealed bids are asked until Sept. 10 for laying 1,200 ft. of 6-in. c. i. water mains. C. Andres, Jr., vil. clk.

Ft. Lincoln, N. D.—Bids are asked un-

til Sept. 6 for laving an 8-in. water main. Will D. Wills, 2d lieut.. constr. Q. M.

Sioux Falls. S. D.—Sealed bids are asked until Sept. 1 for constructing a well. Wm. R. Marshall, secy. bd. water comrs.

Pierre, S. D.—Bids are asked until Sept. 17 for sinking an artesian well. C. F. Larrabee, acting comr. Indian affairs, Washington, D. C.

Moosoomin, Sask.—Bids are asked until Sept. 4 for constructing waterworks and sewerage systems. John Smithers. secy.-treas.

Lockport, N. Y.—Bids are asked until Oct. 8 for constructing a water supply system and distributing main. E. S. Bennett, cy. clk.

Spencer, Ia.—Sealed bids are asked until Sept. 5 for constructing a 70,000 gal. steel tank on a 100-ft. steel tower. R. L. Taylor, cy. clk.

Lakewood, O.—Sealed bids are asked until Sept. 8 for laying water mains in several avenues. E. R. Lieblein. clk. bd. trustees pub. affairs.

St. Louis, Mo.—Bids are asked until Sept. 4 for supplying water pipes. special castings, stop valves and fire plugs. A. J. O'Reilly, prest. B. P. I.

Chemawa, Ore.—Sealed bids are asked until Sept. 13 for constructing a water system here. C. F. Larrabee, com. Indian affairs, Washington, D. C.

Regina. Sask.—Bids are asked until Sept. 15 for completing the waterworks system and constructing a sewerage system. J. Kelso Hunter, cy. clk.

Washington, D. C.—Sealed bids are asked until 12 m. Sept. 1 for furnishing 600 tons of 8-in. c. i. water pipe. Henry L. West, chmn. Dist. Comrs.

Corning, N. Y.—Bids are asked until Sept. 5 for 2 gas engines with gas producer plant for same, and 2 power pumps. W. J. Heermans, secy. water comrs.

Washington. D. C.—Bids are asked until Sept. 4 for furnishing pipe, pipe fittings, valves, etc. D. W. Ross, genl. purchasing officer Isthmian canal comn.

Portland, Ore.—Bids are asked until 11 a. m. Sept. 1 for furnishing 2,000 ¼-in. and 5.000 5-8-in. corporation stop cocks. Frank T. Dodge, supt. water dept.

Two Rivers, Wis.—Bids are asked until Sept. 5 for laying 1,620 ft. of 4-in. pipe on Williams st. and 500 ft. of 6-in. pipe on Jefferson st. Water and lgt. comn.

Columbus, O.—Sealed bids are asked until Sept. 14 for building a dam across Walhonding river, 6 mis. west of Roscoe. O. Chas. E. Perkins, ch. engr. pub. wks.

Rockingham, N. C.—Bids are asked until about Sept. 10 for waterworks for the Rockingham Water Co. Pressey & Weller. engrs., 1416 F st., N. W., Washington. D. C.

Ottawa, Can.—Sealed bids are asked until Sept. 10 for constructing a concrete lock and dam at St. Andrew's Rapids, Red River, Man. Fred Gelinas, secy. dept. pub. wks., Ottawa.

South Bartonville, Ill.—Bids are asked until Sept. 4 for additions and extensions to the present heating and water supply plant. Trustees for Ill. Asylum for Incurable Insane.

New York City—Bids are asked until Sept. 12 for furnishing an experimental filter station at the south end of Jerome Park reservoir, Boro Bronx. Wm. B. Ellison, comr. water supply. etc.

White Plains, N. Y.—Bids are asked until Sept. 2 for excavating and back-filling trenches for 14-in. water mains, gates, hydrants and specials in 5 streets. Lewis C. Pratt, prest. bd. water comrs.

Garden City, Kas.—Sealed bids are asked until Sept. 28 for constructing deep and shallow wells, suction pipes, pumping stations, siphons, concrete lined conduits and fencing. Thos. Ryan, acting secy.. Washington, D. C.

Cincinnati, O.—Sealed bids are asked until Sept. 28 for furnishing, delivering and placing operating machinery and apparatus for the filtration plant and settling reservoirs near the village of California. Aug. Herrmann, prest. bd trustees.

New Orleans. La.—Sealed bids are asked until Sept. 5 for furnishing and erecting 2 complete water purification plants, including excavations, foundations, concrete masonry, reservoirs and filters, wharf and intake, coal storage. machinery for handling coal and other mechanical equipment, and all piping and appurtenances complete. Geo. G. Earl, genl. supt.

CONTRACTS AWARDED.

Blue Earth, Minn.—The contract for extending the water mains was awarded to W. E. Young.

Rockingham, N. C.—A franchise has been granted Pressey & Weller, of Washington, D. C.. to construct waterworks here.

Fremont, Mich.—The contract for constructing a waterworks system was awarded to the Scheiler Construction Co., of Muskegon, Mich., for $7,750.

Wilmington. Del.—The contract for constructing a waterworks system was ed, Aug. 13, to the Pittsburg Filter Mfg. Co., of Pittsburg, for $63,546.

Chariton, Ia.—The contract for constructing a waterowrks system was awarded, Aug. 14, to the American Light & Water Co., of Kansas City, for $36,-666.66.

Lewiston, Mont.—M. J. Littlejohn was awarded the contract for constructing 6 mis. of 10 and 12-in. wooden pipe line for a gravity water system, for $27,590.

Spokane, Wash.—The Sylvan Home Water Co. has been granted a franchise for laying water mains and pipes in all the streets and alleys in the Sylvan Home addition and across the Sylvan Home tract.

Tacoma, Wash.—The contract for the extension of water mains was awarded, Aug. 13, to J. W. Murphy, for $2,174. George Milton Savage was awarded a contract for constructing a 6-in. wooden main on certain streets for $2,563.

Pittsburg, Pa.—The contract for laying the Goss street system of water pipes was awarded, Aug. 9, to the International Construction Co.. for $51,473.80, and the Millvale ave. system was awarded to Raphael Verri & Co.. for $3,957.07.

Grand Rapids, Mich.—The lowest bid submitted Aug. 22 for constructing the new waterworks inlet at Emerald reef, with 2 tunnels, shaft and foundation and dock for the new pumping plant was that of the Buffalo Dredging Co., of Buffalo, N. Y., for $1,272,763.73.

Perth Amboy, N. J.—A contract for 2,250 ft. of 6-in. water main to be used in connection with the proposed new wells at Runyon has been awarded to the Crane Co. of New York city. Contracts were awarded to the Neptune Meter Co. and the Hersey Co. for furnishing 10 water meters each and to the Worthington Co. for 6 meters.

BRIDGES.

Fargo, N. D.—Bids are asked until Sept. 4 for building a steel bridge. A. G. Lewis. co. audt.

Brainerd, Minn.—Bids are asked until Sept. 4 for building a steel bridge. A. Mahlum. co. audt.

Sidney, O.—Bids are asked until Sept. 1 for constructing a number of bridges. J. C. Rosser, co. audt.

Daggett, Cal.—Bids are asked until Oct. 8 for constructing a steel bridge over Mojave river. Co. super.

Monson, Mass.—Voted Aug. 2 to build a bridge to replace the old one at South Main st. E. L. Pack, co. clk.

Belfast, N. Y.—Plans have been prepared for a bridge 3,120 ft. long and 140 ft. high across the Genesee river.

Indianapolis, Ind.—Blaine Miller has prepared plans for a bridge across the canal at 29th st. The contract will be let soon.

Bradford, R. I.—Bids are asked until Oct. 3 for two steel girder bridges. Wm. S. Cowles, chf. Navy Dept., Washington. D. C.

Jefferson, O.—Bids are asked until Sept. 5 for constructing reinforced concrete bridge over Mill creek. T. C. Remick, co. audt.

Cleveland, O.—Bids are asked until Sept. 1 for constructing a concrete masonry arch in Euclid twp. William H. Evers, co. engr.

Milwaukee. Wis.—Bids are asked until Sept. 14 for bascule bridge over North Menomonee river at 60th st. Chas. J. Poetsch, cy. engr.

Escanaba, Mich.—Bids are asked until Sept. 4 for bulding three bridges with stone abutments and steel beams. D. C. Brotherton, cy. engr.

Scotts Mill, Ore.—Bids are asked until Sept. 7 for building a Howe truss bridge across Butte creek. John H. Scott, co. judge, Salem.

Portland. Ore.—Bids are asked until Sept. 7 for building a Howe truss bridge concrete bridge on Grand ave. Thos. C. Dublin. cy. audt.

Kansas City, Mo.—Bids are asked until Sept. 4 for constructing a rubble stone bridge at the crossing of Blue Ridge road. J. L. Phelp, co. clk.

Parkersburg, W. Va.—The Parkersburg & South Side Bridge Co. has had plans and specifications prepared for a bridge across the Little Kanawha river.

Grand Rapids, Mich.—Sealed bids will be asked Sept. 7 for constructing 2 abutments and 3 piers for the Ann st. bridge across Grand river. L. W. Anderson, cy. engr.

Rapid City, S. D.—Bids are asked until Sept. 4 for moving a steel bridge across Rapids creek. near Creston P. O., and resetting same 1 1-2 miles east. Robert Rudesill, co. audt.

Cincinnati, O.—An ordinance has been passed providing for the issue of $140,000 bonds for the purpose of reconstruction and repairing the Liberty st. viaduct. Edwin Henderson, clk. council.

Peoria, Ill.—Specifications for the proposed new city bridge at the foot of Bridge st. have been prepared by the Concrete Steel Engineering Co., of New York city, and bids are asked until Sept. 4.

Fort Lauderdale, Fla.—Bids are asked until Sept. 4 for removing bridge which has fallen into New River here, and replacing same in satisfactory condition. H. A. Dearborn, clk. circuit court, Miami, Fla.

Perth Amboy, N. J.—Bids are asked until Sept. 12 for removal of 450 ft. of bridge and erection of three 150 ft. steel spans and the necessary piers for same in the Amboy bridge. over the Raritan river. L. C. Brogger, co. engr.

Spokane, Wash.—Bids are asked until Sept. 13 for constructing a reinforced steel concrete bridge across north channel of Spokane river; a single reinforced concrete bridge across south center channel of Spokane river; a reinforced steel concrete double or Y bridge across south center channel of Spokane river. J. T. O'Brien, secy. B. W. W.

Memphis, Tenn.—Bids are asked until Sept. 3 for raising a steel span of the county bridge over Loosahatchie river on the Randolph road, near Woodstock. about 10 ft. above its present grade. Also raising steel span over the Moncannah on the Hornlake road, at New South Memphis, about 4.5 ft. above present grade, and building two concrete shore piers and two 18 ft. steel approaches. Chas. A. Barton, engr, levee comis.

STREET LIGHTING.

Boston, Ga.—Voted to install a municipal electric light plant.

Mahone City, Miss.—Voted to install an electric light plant.

Harrodsburg. Ky.—A municipal electric light plant is contemplated.

Covington, Ky.—Plans for new electric light plant have been accepted.

Bellevue, Pa.—A 5-year contract has been awarded the Ohio Valley Light Co.

Fremont, Neb.—Voted to issue bonds to build a new electric light plant.

Lumberton, N. C.—Voted to issue bonds for extending electric light plant.

Kearney. Neb.—Voted to issue bonds to install municipal gas lighting plant.

Nebraska City, Neb.—A municipal eltctric light and water plant is contemplated.

Brownsville, Tex.—The construction of electric light and power plants is contemplated.

Wellington, Kas.—Will vote on issue of bonds for electric light and waterworks plant.

Cameron, Mo.—Voted to issue $9,000 bonds for extending waterworks and electric light plants.

Madisonville, Ky.—Estimates have been prepared for an electric light plant. Jas. L. Brown, cy. clk.

Oroville, Cal.—City trustees have decided to establish a municipal water, gas and electric plant.

Bellville, Kas.—Voted to issue $20,000 bonds for constructing a municipal electric light plant.

Sapulpa, I. T.—An effort will be made to organize a company to install an electric light plant.

Anniston. Ala.—Bids are asked until Sept. 20 for furnishing electric arc lights. Thos. E. Kilby, mayor.

Black Diamond, Cal.—Question of issuing bonds for an electric light plant and waterworks is being considered.

Carmi, Ill.—The rebuilding of the municipal electric lighting system is contemplated. D. Clinton Smith, supt.

Lone Tree, Ia.—Work of construction on the proposed new electric light plant will begin soon. Wm. Zimmerman interested.

Woburn, Mass.—Preliminary steps have been taken in the construction of an electric lighting plant. John H. Quinn, cy. clk.

Clinton, Mo.—Bids are asked until Sept. 18 for constructing an electric light plant. G. B. Berry, cy. clk.; W. H. Shackerford, mayor.

Malvern, Ark.—Bids are asked utnil Sept. 30 for erecting an electric light plant to replace the one recently destroyed by fire. C. W. Turner.

Napoleonville, La.—Mayor Gilbert has appointed a committee to investigate the probable cost of a municipal electric light plant.

Pottsville. Pa.—Bids are asked until Sept. 18 for lighting the streets and buildings with electricity or gas. G. A. Burner, town clk.

Niles. Mich.—This city has granted the Chapin Power Co. of Buchanan, the right to bring power into the city for manufacturing purposes only.

Havana, Ill.—Robt. F. Merke, of Milwaukee, Wis., and others have asked for a 25-year franchise to conduct a gas company, to furnish gas for this city.

Ogdensburg, N. Y.—The Pittsburg Reduction Co. obtained absolute control, Aug. 16, of the extensive electric power facilities at Massena, N. Y.

Crowley, La.—Bids are asked until Oct. 5 for an electric light plant. waterworks and sewerage systems, according to press reports. Geo. H. Horton, cy. clk.

Racine, Wis.—Plans and specifications have been made for 30 new retorts, new condensers and purifying apparatus, at the plant of the Racine Gas Light Co.

Beatrice, Neb.—A franchise to operate a 16-candlepower gas light plant in this city has been granted to Droctor Eaton, of Cleveland, O. The proposed plant will cost $50,000.

Christal Falls, Mich.—The installation of a general electric series—alternating current—arc system in the municipal electric lighting plant is contemplated. Q. Stephany. supt.

Portland, Me.—City council voted to recommend the cancellation of the present contract with the Portland Electric Light & Power Co., and that a new contract be made for 20 years.

Madison. S. D.—The installation of a series incandescent street lighting system, with regulators, is contemplated in the municipal lighting plant. Roy Faulkerson, mgr.

Ft. Omaha, Neb.—Bids are asked until Sept. 10 for furnishing and installing transformer, service wires and watt meter for electric lighting post exchange and gymnasium here. Mayor M. Gran Ziniiski, constr. Q. M.

Lakewood, O.—The question of issuing $25,000 bonds for extending, enlarging, improving and repairing the electric light works of this village will be voted on Oct. 16. Bernard Miller. mayor.

Milwaukee, Wis.—Press reports of Aug. 9 state that council's committee on street lights would, at next meeting. appoint an electrical engineer to prepare plans for a municipal lighting plant.

Winn, Ark.—This city contemplates changing the system of municipal electric light plant from direct to alternating current, and will extend their electric lines into new districts. John C. Cobey, mgr.

Denver, Colo.—The board of supervisors has authorized a contract between the Denver Gas & Electric Co. and this city for 10 years. whereby the city is to be furnished with arc lamps at the rate of $60 per lamp.

Mobile, Ala.—Bids are asked until Oct. 1 for the erection and equipment of a municipal electric light plant; also 600 arc lamps and power lines complete, with main station, stack and sub-station. Patrick J. Lyons, mayor.

St. Louis, Mo.—Lighting contracts were awarded Aug. 17 as follows: Dist. No. 1, Laclede Gas Light Co., 5½ cents per thousand watt hours; Dist. No. 2, Union Electric Light & Power Co., 4½ cents per one thousand watt hours.

Eveleth, Minn.—The Virginia Water & Light Co. have asked for permission to furnish light to supply consumers here. As there is considerable agitation for municipal plant the council will probably contract for street lighting for one year only.

Kansas City, Mo.—The fight for cheap gas in this city received a setback Aug. 14. when a syndicate of Chicago capitalists, who recently received a 3-year franchise to furnish the city with natural gas at 25 cents per thousand feet for domestic use and 10 cents for manufacturing purposes, notified Mayor Beardsley that they could not accept the proposition. The franchise, they claim, carried too many restrictions.

Albany, N. Y.—The Southern Dutchess Gas & Electric Co., of Franklin. and Matteawan Electric Light Co., operating under lease the plant of the Citizens' Railroad. Light & Power Co., has asked for permission to issue $90,000 bonds to acquire and improve property lately owned and operated by the Fishkill and Matteawan Gas Co., gas plant recently sold under foreclosure proceedings. A hearing will be given by the commission.

Newly incorporated companies: Casey, Ill., Casey Water, Power & Mineral Co., J. T. Turner, F. Hammond, R. A. Young; Hartford. Conn., Evansville Light Co., Chas. E. Perkins. Hartford, and H. Clay Durgee, Jr., and G. Richard Nichols, of Philadelphia; Dallas, Tex., The Dallas Light & Equipment Co., T. L. Camp, J. B. Nabors, C. E. Bird, J. A. Barnhard of Dallas, and A. P. McArthur of New York city; Grayson. Ky., Grayson Light Co.; De Kalb. Ill., De Kalb Fuel, Light & Power Co., John Ross McCulloch, O. N. Guldlin and Chas. M. Prince of Ft. Wayne.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Elkton, W. Va.—Voted to construct a garbage crematory.

Columbus, O.—Bids will be asked soon for a garbage disposal plant. Henry Maetzel, cy. engr.

Fort Dupont, Del.—Bids will be asked until Sept. 12 for constructing a garbage crematory here. Capt. Lewis F. Girard.

Sacramento. Cal.—The Decarie Mfg. Co. of Minneapolis, Minn., has been awarded a contract for constructing a garbage crematory, at $25,000.

Baltimore, Md.—Michael T. Horner & Co., 1018 Ashland ave., has been awarded a contract for removing street dirt at 30 cents a cubic yard.

Chicago, Ill.—The Chicago Reduction Co. has been incorporated for the purpose of reducing wastes, by Chas. Turner, Andrew A. Bruce and Claude A. Gray.

Wilmington, Del.—Wilmington Sanitary Co. is preparing to make alterations at the city garbage crematory in order to utilize the building for the disposal of garbage after the company's contract becomes effective. Oct. 1.

Utica, N. Y.—Council has authorized the city clerk to procure bids for the re-

moval of ashes and rubbish, and for the collection and removal of garbage for one, three and five years; also for cleaning the paved streets for one, three and five years.

Portland, Me.—L. A. Goudy, of the board of trade, and the city committee visited the principal cities of New England, recently, for the purpose of investigating street sprinkling methods. It was learned that the cities of Lynn, Worcester and Springfield, Mass.. and Hartford, Conn., have adopted and highly commend the street railway sprinkling system, and such system has been recommended for this city.

PARKS.

Iowa City, Ia.—This city has purchased an 80-acre tract and will develop it as a public park.

Birmingham, Ala.—This city has purchased 100 acres at the foot of Red Mountain for a public park.

Cedar Rapids, Ia.—Messrs. Loss and Daniels have presented 18 acres to this city for park purposes.

Saginaw, Mich.—This city contemplates raising a fund of $200,000 for establishing new parks. Ten citizens have subscribed $10,000 each. and the city is to issue bonds for $100,000.

Centerville, Ind.—A tract of land has been presented to this city by Dr. Calvin Woods for a public park. on condition that the city erect a fountain and pipe water to the park.

Des Moines, Ia.—The park board will ask city council's permission to convert the Old Sunnyside Cemetery, occupying about four blocks on the east side of the river, into a public park.

Tacoma, Wash.—The Fire, Water & Light Com. of city council has adopted a resolution ordering the placing of drinking fountains at S. 12th and C sts. and Pacific and St. Helen aves.

FIRE APPARATUS.

Dexter, Me.—The question of installing a fire alarm system is being agitated.

Ventnor, N. J.—City council has authorized the purchase of a chemical combination hose wagon. V. Albertson, chmn. com.

TOO LATE FOR CLASSIFICATION

Toledo, O.—Bids will be asked soon for constructing a large number of sidewalks.

Elmcreek, Neb.—Voted to issue $10,000 bonds for erecting a municipal water plant.

Zanesville. O.—An ordinance has been passed providing for a storm and sanitary sewer on Greenwood ave.

Chula, Mo.—The business men of this place are considering the matter of constructing an electric light plant.

St. Louis, Mo.—The Affiliated Business Men's Association is working on a plan for a municipal lighting plant.

Herkimer, N. Y.—Bids are asked until Sept. 3 for erecting a bridge over the hydraulic canal at Greene st. Vil. bd.

Bay City, Mich.—Sealed bids are asked until Sept. 3 for constructing a sewer on Warner ave. G. Hime, cmn. B. P. W.

Ivesdale. Ill.—The contract for constructing concrete walks has been awarded to J. P. McPherran, of Homer, for $1,000.

Freeport, Ill.—Bids are asked until 7:30 p. m. Sept. 2 for constructing a concrete culvert across West st. Highway comrs.

Bucyrus, O.—The contract for paving Prospect st. was awarded to W. H. Raymond & Co., for $8,750. Athens block will be used.

Hallock, Minn.—Bids are asked until Sept. 3 for the sale of $10,000 village bonds for the construction of a sewerage system.

Rifle, Colo.—The contract for constructing a waterworks system has been awarded to J. J. Lumsden. of Grand Junction, for $45,000.

Westfield, N. J.—Bids are asked until Sept. 4 for furnishing and laying 36,500 sq. ft. of 2-in. blue stone flagging. A. W. Bars, town surv.

Portland. Ore.—The contract for building the Brooklyn district sewer was awarded, Aug. 20, to Paquet, Giebisch & Joplin, for $242,377.52.

Portland, Ore.—The question of constructing an 80 ft. boulevard on Villa ave., from E. 28th st. to Fairview, a distance of more than 10 miles, is being discussed.

Brownsville, Tex.—A waterworks and electric light franchise has been granted to the Brownsville, Water. Light & Power Co. The plant will cost nearly $100,000.

Selma, Ala.—Committees from the Commercial and Industrial Associations are devising ways and means for paving the principal business streets of this city.

Joliet, Ill.—The property owners in the 6th ward have petitioned for the construction of concrete instead of brick manholes and catch basins, in Duncan and Ottawa sts.

Dayton, O.—Bids submitted Aug. 17 for installing a new high pressure water system were: Chas. L. Allen, Marion. O., $90,010.75; Pickerel & Ratchford, Dayton, $97.949.30.

Elm Grove, W. Va.—Bids are asked until Sept. 15 for the purchase of $18,000 bonds, the proceeds to be used in improving and extending the sewerage system. J. E. Raub, chmn. bd. comrs.

Napoleon, O.—A resolution has been passed providing for the construction of a combination sanitary sewer on Cary st., from Scott st. to Woodlawn ave. D. C. Brown, prest. coun.

Champaign, Ill.—The contract for paving E. Elm st. and Bennett ave. with brick was awarded to John W. Stipes, at $1.41 a sq. yd. The contract for concrete curb and gutter was awarded to Walsh & Hawley.

Ft. Worth, Tex.—Chmn. Harrold, of the w. w. com., has made recommendations for the reduction of the cost of operating the waterworks system. Among other things he recommends the construction of a reservoir.

New York City—The municipal water commission has announced that on Oct. 1 it will advertise for bids for the first section of the new 90-mile aqueduct to the Catskills. This section will extend from Croton Falls to a point north of Peekskill. a distance of 35 miles.

Helena, Mont.—Bids are asked until Sept. 3 for macadamizing Helena ave., requiring 4,500 cu. yds. broken stone; 3,500 yds. filling gravel or decomposed granite; 3,000 yds. exca.; watering and rolling, 240,000 sq. ft.; 5,300 lin. ft. gutters. F. J. Sterling. cy. clk.

WHITE PORTLAND CEMENT

Attractiveness is an important feature of block or ornamental concrete work. The principal disadvantage in this kind of concrete work has been its dark, and to many people, disagreeable appearance.

You are now able to entirely overcome this objection by using Parthenon Brand White Portland Cement. The use of this cement enables you to give your work a clean white appearance, extremely pleasing to the eye. The white color is the cement itself and it is impossible for it to fade or wash off. You can get a much better appearing stone by mixing Parthenon Brand with ordinary bank sand than by mixing any other Portland cement with marble dust. Mix Parthenon Brand with marble dust or crushed white stone and the result is a most beautiful and pleasing concrete.

You are perfectly safe in using Parthenon Brand for facing. It is a true Portland cement, meeting the requirements demanded of any high grade Portland, and when used for facing its chemical action is in conformity with the ordinary Portland used in the work proper. It is equal in strength to any high grade Portland and superior in fineness.

It possesses waterproofing qualities equal to that of Portland cement treated with one per cent of any waterproofing compound on the market.

It is non-staining and is unexcelled for cement mortar.

Its use will enable you to sell more work at a much higher price than you are now getting.

Write for further particulars, tests, etc.

ART PORTLAND CEMENT CO.

KIMMELL, INDIANA.